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Governance Structure Choices in Supply Chain Management - Evidence from Spanish and Chinese Pork Chain Cases

TESIS DOCTORAL

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“Sólo es posible avanzar cuando se mira lejos”

“Sólo es posible progresar cuando se piensa en grande”

José Ortega y Gasset

Preface

This thesis gives a research on governance choices in supply chain management through three main perspectives. They are comparative studies in pork chain between Spain and China, international pork chain management, and empirical studies on governance structure choice in China´s pork chain. When I look back the journey of pursuing my PhD in Spain, I see that many people have contributed to the completion of my thesis. Therefore, I want to take this place to give my sincere thanks.

I started the studies on pork chains in 2007 when I participated in the EU 6th framework project titled “Q-pork Chains (**FP**6-036245-2)” in China. I helped the project coordinators in China, who are Professor Wang Kai and Professor Han Jiqin to complete the work of Chinese part. I met Professor Julián Briz and Professor Isabel de Felipe in Nanjing Agricultural University (NJAU) in September of 2007, when they came to visit us as coordinators of this project in Spain. They kindly offered me the opportunity to continue my PhD study with them in Universidad Politécnica de Madrid (UPM), which encouraged me to apply for the scholarship of Chinese Scholarship Council (CSC) at the end of 2007.

In June, 2008, I achieved my Master degree in Economics and Management of Agri-business of Nanjing Agricultural University in China. At the same time, I got a four-year full scholarship from CSC for doing my PhD in UPM, which made my dream of studying abroad finally come true. I appreciate so much the help given by Professor Wang Kai, Professor Julián Briz and Professor Isabel de Felipe that make my application of sponsorship of CSC possible. I also appreciate a lot the financial support offered by CSC during 2008 to 2012, which makes my trip to Madrid and life here much easier.

I arrived in Madrid on 2nd of November, 2008, with my thinking that English is commonly used in Spain, when I found that I was wrong. I did not understand nearly anything in the first three months and I got to know that mastering Spanish is absolutory necessary. With the help of my Professors, international office of UPM and my colleagues and my friends, I started my hard period of learning Spanish. As time goes by, I am now able to use Spanish in my daily life without big problems. I want to give my special thanks to my colleagues, Marina Gil, Paloma Esteve, Gema Carmona, Irene Blanco, Teresa Briz, Sara Peña, Cristina Fernández, Ana Zapatero, Roberto Rodríguez, Paula Novo, etc. They always tried to talk with me in Spanish so that I could practice.

In my first year of PhD studies, Professor Ana Iglesias, Professor Alberto Garrido, Professor Luis Ambrosio, Professor Ana Velasco, Professor José Luis López have given me a lot of help as I did not understand Spanish, many thanks to them.

The second year I finished my "*Trabajo de Investigación*" with a ten score. My directors Professors Julián and Isabel have arranged me to do investigation in Barcelona, Segovia, Lléida etc., so that I could complete the work. I would like to thank them and Mr. Ramón Armengol from *Cercle Tancat S.L.*, who has kindly helped me a lot during my investigation in Lléida and Barcelona.

I always considered conducting an empirical study on the governance structure choices in China´s pork chain and I was collecting ideas and establishing study framework. Thanks to the financial support of Professor Wang Kai from NJAU with his National Natural Science Foundation Project "Research about Influence of Implementing Supply Chain Management on Ensuring the Supply of Safe Pork (No. 70973053/G0305)", I was able to collect the data I need to the empirical research.

From September to December, 2010, I stayed in Wageningen University, the Netherlands, with Professor Jacques H. Trienekens, who is another expert on chain

studies. He guided me greatly in reconstructing my empirical work and methodology. I made the SEM model to study governance structure choice in China´s pork chain based on useful discussions with him. I would like to give my sincere thanks to Professor Jacques H. Trienekens.

Certainly, I greatly appreciate Mr. Wang Zhiwei and Mrs. Du Yan from Chinese Embassy in Spain. They have given me great concern during my stay in Madrid. I met a lot of Chinese students and I made friends with some of them in the activities they organized.

I also appreciate the help from international office of my university, Mr. Ángel Alvarez, Ms. Carmen Alcalde and Ms. Maria Luisa Escribano etc. All of you have helped me so much that I could never forget all my life.

Many thanks go to my Spanish and Chinese friends from and out of the University as you have made my time in Spain so funny. Thank you, Marina Gil. You have taken me to know such a different social life in Madrid. I enjoyed a lot with you in the parties, and I also enjoyed a lot the time I spent with your family. Thank you, Andrés Gutiérrez. You have supported me without asking reward.

Finally, please let me to give all my greatest thanks to my parents. You gave me the life 27 years ago, and you care for me so much like I was always a little girl. You are the ones who always share my sadness and happiness in my life. Thank you, Mum and Dad. I love you!

Thanks to all the people who have helped me, without you, I would never achieve so much.

Summary

The author participated in the 6th EU Framework Project “Q-pork Chains (FP6-036245-2)” from 2007 to 2009. With understanding of work reports from China and other countries, it is found that compared with other countries, China has great problems in pork quality and safety.

By comparing the pork chain management between China and Spain, It is found that the difference in governance structure is one of the main differences in pork chain management between Spain and China. In China, spot-market relationship still dominates governance structure of pork chain, especially between the numerous house-hold pig holders and the great number of small slaughters. While in Spain, chain agents commonly apply cooperatives or integrations to cooperate. It also has been proven by recent studies, that in quality management at the chain level that supply chain integration has a direct effect on quality management practices (Han, 2010).

Therefore, the author started to investigate the governance structure choices in supply chain management. And it has been set as the first research objective, which is to explain the governance structure choices process and the influencing factors in supply chain management, analyzing the pork chains cases in Spain and in China. During the further investigation, the author noticed the international trade of pork between Spain and China is not smooth since the signature of bi-lateral agreement on pork trade in 2007. Thus, another objective of the research is to find and solve the problems exist in the international pork chain between Spain and China.

For the first objective, to explain the governance structure choices in supply chain management, the thesis conducts research in three main sections.

First of all, the thesis gives a literature overview in chapter two on Supply Chain Management (SCM), agri-food chain management and pork chain management. It concludes that SCM is a systems approach to view the supply chains as a whole, and to manage the total flow of goods inventory from the supplier to the ultimate customer. It includes the bi-directional flow of products (materials and services) and information, and the associated managerial and operational activities. And it also is a customer focus to create unique and individual source of customer value with an appropriate use of resources, leading to customer satisfaction and building competitive chain advantages. Agri-food chain management and pork chain management are applications of SCM in agri-food sector and pork sector respectively.

Then, the research gives a comparative study in chapter three in the pork chain and pork chain management between Spain and China. Many differences are found, while the main difference is governance structure in pork chain management.

Furthermore, the author gives an empirical study on governance structure choice in chapter five. It is concluded that governance structure of supply chain consists of a collection of rules/institutions/constraints structuring the transactions between the various stakeholders. Based on the overview on literatures closely related with governance structure, such as transaction cost economics, transaction value analysis and resource-based view theories, seven hypotheses are proposed, which are:

Hypothesis 1: Transaction cost has positive relationship with governance structure choice

Hypothesis 2: Uncertainty has positive relationship with transaction cost; higher uncertainty exerts high transaction cost

Hypothesis 3: The relationship between asset specificity and transaction cost is positive

Hypothesis 4: Collaboration advantages and governance structure choice have positive relationship

Hypothesis 5: Willingness to collaborate has positive relationship with collaboration advantages

Hypothesis 6: Capability to collaborate has positive relationship with collaboration advantages

Hypothesis 7: Uncertainty has negative effect on collaboration advantages

It is noted that as transaction cost value is negative, the transaction cost mentioned in the hypotheses is its absolute value.

To test the seven hypotheses, Structural Equation Model (SEM) is applied and data collected from 350 pork slaughtering and processing companies in *Jiangsu*, *Shandong* and *Henan* Provinces in China is used.

Based on the empirical SEM model and its results, the seven hypotheses are proved. The author generates several conclusions accordingly. It is found that the governance structure choice of the chain not only depends on transaction cost, it also depends on collaboration advantages. Exchange partners establish more stable and more intense relationship to reduce transaction cost and to maximize collaboration advantages. “Collaboration advantages” in this thesis is defined as the joint value achieved through transaction (mutual activities) of agents in supply chains. This value forms as improvements, mainly in mutual logistics systems, cash response, information exchange, technological improvements and innovative improvements and quality management improvements, etc. Governance structure choice is jointly decided by transaction cost and collaboration advantages. Chain agents take different governance structures to coordinate in order to decrease their transaction cost and to increase their collaboration advantages.

In China´s pork chain case, spot market relationship dominates the governance structure among the numerous backyard pig farmer and small family slaughterhouse

as they are connected by acquaintance relationship and the transaction cost in turn is low. Their relationship is reliable as they know each other in the neighborhood; as a result, spot market relationship is suitable for their exchange.

However, the transaction between large-scale slaughtering and processing industries and small-scale pig producers is becoming difficult. The information hold back behavior and hold-up behavior of small-scale pig producers increase transaction cost between them and large-scale slaughtering and processing industries. Thus, through the more intense and stable relationship between processing industries and pig producers, processing industries reduce the transaction cost and improve the collaboration advantages with their chain partners, in which quality and safety collaboration advantages be increased, meaning that processing industries are able to provide consumers products with better quality and higher safety.

It is also drawn that transaction cost is influenced mainly by uncertainty and asset specificity, which is in line with new institutional economics theories developed by Williamson O. E. In China´s pork chain case, behavioral uncertainty is created by the hold-up behaviors of great numbers of small pig producers, while big slaughtering and processing industries having strong asset specificity.

On the other hand, “collaboration advantages” is influenced by chain agents´ willingness to collaborate and chain agents´ capabilities to cooperate. With the fast growth of big scale slaughtering and processing industries, they are more willing to know and make effort to cooperate with their chain members, and they are more capable to create joint value together with other chain agents. Therefore, they are now the main chain agents who drive more intense and stable governance structure in China’s pork chain.

For the other objective, to find and solve the problems in the international pork chain between Spain and China, the research gives an analysis in chapter four on the

international pork chain. This study gives explanations why the international trade of pork between Spain and China is not sufficient from the chain perspective. It is found that the first obstacle is the high quality and safety requirement set by Chinese government. It makes the Spanish companies difficult to get authorities to export. Other aspects, such as Spanish pork is not competitive in price compared with other countries such as Denmark, United States, Canada, etc., Chinese consumers do not have sufficient information on Spanish pork products, are also important reasons that Spain does not export great quantity of pork products to China.

It is concluded that China´s government has too much concern on the quality and safety requirements to Spanish pork products, which makes trade difficult to complete. The two countries need to establish a more stable and intense trade relationship. They also should make the information exchange sufficient and efficient and try to break trade barriers. Spanish companies should consider proper price strategies to win the Chinese pork market.

Resumen (Summary in Spanish)

La autora participó en el “6th EU Framework Project “Q-pork Chains (FP6-036245-2)” desde 2.007 a 2.009. Debido a la investigación y comprensión de lo que se hace en otros países y su posterior comparación con China, surge la idea de que los problemas en la calidad y seguridad en el sector porcino en China son evidentes e importantes.

Comparando la gestión de la cadena porcina entre China y España, se observa claramente que hay diferencias en las relaciones que existen entre los actores de la cadena ambos países. En China el tipo más común en la relación entre los actores que interactúan en la cadena porcina es el “spot market”. Este tipo de relación se basa en no estar sujeta a contratos. También es frecuente debido a que la mayoría de las veces se interrelacionan productores y mataderos pequeños, mientras que en España esto no sucede, ya que entran en juego las cooperativas, que impiden que un productor o matadero pequeño se convierta en actor de la cadena porcina española. La investigadora china Jiqin Han, en sus recientes estudios demostró que las diferentes relaciones entre los actores de la cadena afectan de lleno a la calidad y seguridad de los productos porcinos.

Por lo tanto, el objetivo principal de la tesis, gracias a la investigación llevada a cabo en China y en España, es explicar las diversas opciones en la relación entre los actores de la cadena porcina china. Profundizando en la investigación, se detecta un segundo objetivo, que es que el comercio internacional de productos porcinos entre España y China, que comenzó en 2.007, es bajo, comparado con el que tiene China con otros países, por lo que se busca encontrar las razones y posibles soluciones para mejorar las exportaciones e importaciones entre ambos países.

Para conseguir el primer objetivo, que es explicar las diversas opciones en la relación

entre los actores de la cadena porcina China, la tesis se divide en tres áreas.

La primera se desarrolla en el Capítulo 2, explicando “Supply Chain Management (SCM)” que se habla de las gestiones que se deben hacer teóricamente en las cadenas porcinas y agroalimentarias. Se deduce que el “SCM” hace un enfoque sistemático para ver las cadenas de suministro en su conjunto y para ver el manejo del flujo total de inventario de productos desde el proveedor hasta el consumidor final. Incluye el flujo bidireccional de los productos (materiales y servicios), su información y las actividades asociadas con su gestión y operativa. También es un enfoque hacia los consumidores para crear valor único e individual con un uso adecuado de los recursos, aumentando la satisfacción del consumidor, por lo tanto, el “SCM” consigue ventajas competitivas de la cadena. La gestión de la cadena agroalimentaria y porcina son aplicaciones del “SCM” en los sectores agroalimentario y porcino.

La investigación prosigue con la presentación de un estudio comparativo en el Capítulo 3, que habla de la cadena porcina y su gestión desigual entre España y China. Muchas diferencias se han encontrado, la principal está en las diversas opciones en la relación entre los actores de la cadena que hay en su gestión.

Profundizando en la investigación, se hace un estudio empírico sobre la elección de las varias opciones en la relación entre los actores de la cadena en el Capítulo 5. Se define, la frase muchas veces utilizada, de las opciones en la relación entre los actores de la cadena de suministro que es un conjunto de reglas/instituciones/restricciones de la estructuración de las transacciones entre los diferentes actores. Basado en las teorías anteriormente explicadas sobre “transaction cost economics”, “transaction value” y “resource-based view theories”, se proponen siete hipótesis, que son las siguientes:

Hipótesis 1: Los costes económicos de transacción tienen una relación directa favorable con la elección de las diversas opciones en la relación entre los actores de

la cadena.

Hipótesis 2: La incertidumbre tiene relación directa con los costes de transacción, una elevada incertidumbre provoca mayores costes de transacción.

Hipótesis 3: La relación entre "asset specificity" y el coste de transacción es directa.

Hipótesis 4: Las ventajas de la colaboración y la elección de las diversas opciones en la relación entre los actores de la cadena tiene una relación favorable.

Hipótesis 5: La voluntad de colaborar tiene relación favorable con las ventajas de la colaboración.

Hipótesis 6: La capacidad de colaborar tiene relación favorable con las ventajas de la colaboración.

Hipótesis 7: La incertidumbre tiene un efecto negativo sobre las ventajas de la colaboración.

Es importante la observación que los costes de transacción son un valor negativo, pero en las hipótesis se ha utilizado como valor absoluto.

Para poner a prueba las siete hipótesis, se ha utilizado el "Modelo de Ecuaciones Estructurales (SEM)" y cotejado con los datos recogidos de 350 empresas chinas que son mataderos o procesadoras de productos porcinos situadas en Jiangsu, Shandong y Henan.

Basado en el modelo empírico "SEM" y sus resultados, se han contrastado las siete hipótesis y se han deducido una serie de conclusiones.

Se ha encontrado que la elección de las diversas opciones en la relación entre los actores de la cadena no sólo depende de los costes de transacción, sino también las ganancias de la transacción. En esta tesis se define como el valor conjunto que se logra a través de transacciones (actividades de mutuo interés) de los actores en las cadenas de suministro a una relación más estable y más intensa para reducir los costes de transacción y maximizar las ganancias. Esto hace referencia al valor de las mejoras, tecnológicas, innovadoras y en la calidad de gestión, en los sistemas de logística mutua, el dinero en efectivo o el intercambio de información. La elección de las varias opciones en la relación entre los actores de la cadena se decide dependiendo de los costes de transacción y sus ganancias. Los actores de la cadena tienen distintas maneras de interactuar y coordinarse con el fin de disminuir sus costes y aumentar sus ganancias de la transacción.

En la investigación también se observa que el tipo más común en la relación entre los actores que interactúan en la cadena porcina china es el “spot market”, en los productores y mataderos pequeños. Normalmente está conexión es tan fuerte debido a factores como la ubicación, la costumbre y los bajos costes de transacción, lo que hace que sea la manera más fiable para esos mataderos y productores pequeños, ya que es adecuado para su intercambio.

Sin embargo, la transacción entre las grandes industrias de sacrificio y procesamiento, y los pequeños productores de cerdos es cada vez más difícil. La información que dan los pequeños productores es escasa y, normalmente, no dicen toda la verdad y se aprovechan de las grandes industrias. Por lo tanto, estas grandes empresas son capaces de reducir los costes de transacción y mejorar sus ganancias con los otros agentes de la cadena. Lo más importante es que la calidad y seguridad de las transacciones se incrementa, lo que significa que las industrias de procesamiento son capaces de ofrecer productos a los consumidores con mejor calidad y mayor seguridad.

Se señala también que los costes de transacción están influenciados principalmente por la incertidumbre y la especificidad de recursos (“asset specificity”), que está en consonancia con las nuevas teorías de la economía institucional desarrollado por Williamson O.E. En el caso de la cadena porcina de China, la incertidumbre se crea por el gran número de pequeños productores. Mientras que las grandes industrias tienen el “asset specificity”.

Por otro lado, las ventajas de la colaboración tienen correlación con la voluntad de colaborar entre los actores de la cadena y su posterior capacidad. Con el rápido crecimiento de las grandes industrias, estas están más dispuestas a conocer y hacer lo posible para cooperar con los agentes de su cadena, y su posterior capacidad de crear valor conjunto con los otros actores de la cadena. Por lo tanto, esas grandes industrias son los agentes de la cadena que intentar mejorar la relación con los otros actores que participan en la cadena porcina China.

Para buscar una respuesta al segundo objetivo, que es saber por qué el comercio internacional entre España y China en todo lo referente a productos porcinos es bajo comparado con el que tiene China con otros países, la investigación ofrece un análisis en el Capítulo 4 de la cadena porcina y su mercado internacional entre España y China. Se ofrecen explicaciones del por qué el comercio internacional de productos porcinos entre España y China no es tan fuerte. Se ha detectado que el primer obstáculo es la alta calidad y requisitos de seguridad establecidos por el Gobierno Chino, lo que hace que las empresas Españolas tengan dificultad en la exportación de productos porcinos. Otro detalle bastante importante, es que el cerdo español, siendo el de mayor calidad, no es competitivo en precio en comparación con otros países como Dinamarca, Estados Unidos, Canadá, etc.. Debido a causas de menores costes de explotación y de exportación, a los consumidores chinos no les llega suficiente información sobre la calidad de los productos porcinos españoles, eso unido a que España no exporta grandes cantidades a China hace que el precio sea alto comparado con el de otros países, y los consumidores chinos se decanten por

productos porcinos de bajo precio.

En conclusión, el Gobierno Chino se preocupa bastante en estos momentos de la calidad y seguridad con los productos porcinos españoles, lo que dificulta que el comercio crezca entre ambos países. España y China deberían establecer una relación comercial más estable e intensa. También España debe hacer un intercambio de información suficiente y eficiente para que el consumidor en China conozca la calidad del cerdo ibérico debe tratar de romper las barreras comerciales. Las compañías españolas deberían considerar las estrategias adecuadas de precios para ganar o mejorar el mercado porcino en China.

论文概述 (Summary in Chinese)

作者于 2007 年至 2009 年期间参与完成了欧盟第六框架项目 “基于质量的猪肉产业链（FP6-036245-2）”。在项目的合作中，作者了解到中国以及其他国家猪肉产业及猪肉产业链的相关情况，并通过对比发现，中国的猪肉产业存在着严重的质量安全问题。

在对中国和西班牙猪肉产业链管理的对比中，作者注意到产业链的治理结构是两国猪肉产业链管理的主要不同点之一。在中国，现货市场（spot market）的交易方式，尤其是众多小型的家庭式养殖户和小型的屠宰商之间的现货市场的交易方式，主导着其猪肉产业链的治理结构。而在西班牙，产业链成员间则普遍的采用垂直一体化或合作社的交易方式进行合作。相关学者的研究证明，产业链的垂直协作对食品质量安全管理有直接的影响（韩纪琴， 2010）。

因此，作者开始集中研究产业链管理中治理结构的选择问题，并研究影响治理结构选择的因素，以了解怎样才能促使产业链成员采取更为紧密一体化治理结构来保障猪肉质量安全。因此，本文通过对中国和西班牙猪肉产业链的研究，解释产业链治理结构选择的过程和影响因素。在进一步的研究中，作者注意到，自2007年中西签署猪肉贸易协议以来，西班牙和中国之间的猪肉进出口并不通畅。因此本文同时对中国和西班牙猪肉进出口国际产业链上的问题进行研究，并对这些问题予以解决。

本文的研究内容主要为三个部分。首先，作者在第二章中对产业链管理，食品链管理和猪肉链管理的理论进行了详细的回顾。在理论回顾的基础上，本文总结，产业链管理是一项系统工程，它将产业链看做一个整体，管理从生产者到消费者之间的物质流动以及产业链成员间的产品（原料和服务），信息，相关的管理和运营活动的双向流动。它以顾客为中心，倡导合理的利用资源为顾客创造独特而个性的价值，从而达到顾客满意度，并因此为产业链建立竞争优势。食品链管理和猪肉链管理是产业链管理分别在食品产业和猪肉产业的具体应用。

接着，本文在第三章中对西班牙和中国的猪肉产业链及其管理进行了对比研究。通过对比研究，两国的猪肉产业链及产业链管理有诸多不同，而主要的不同点就在于产业链的治理结构。

为了找出并解决西班牙与中国之间国际猪肉产业链的问题，论文在第四章给出了相关的研究。本文对西班牙与中国之间的猪肉国际贸易量不足的原因从产业链的角度进行了解释。研究发现，西中猪肉贸易的首要障碍在于中国对西班牙进口猪肉设置了较高的质量安全准入门，这使得西班牙的猪肉企业很难获得出口许可。从其他方面来说，相较于丹麦，美国和加拿大等国，西班牙出口中国猪肉的价格不具有竞争力，中国消费者没有足够的关于西班牙猪肉产品的信息等也是影响西班牙出口中国猪肉贸易的因素。

进一步的，作者在第五章中对产业链的治理结构选择进行了实证研究。产业链的治理结构在本文中被定义为产业链成员间一系列的组成交易方式的规则（或制度，约束）的集合。在对与产业链治理结构密切相关的交易成本理论，交易所得理论和资源基础理论的回顾的基础上，本文提出了七个基本假设。这七个基本假设分别为：

假设 1：交易成本与治理结构选择呈正相关关系

假设 2：不确定性对交易成本成本有正向影响，不确定性越高，带来的交易成本也越高

假设 3：资产专用性对交易成本的影响为正向

假设 4：交易所得与治理结构选择成正相关关系

假设 5：合作意愿正向影响交易所得

假设 6：合作能力和交易所得呈正相关关系

假设 7：不确定性对交易所得有负向影响

值得注意的是，交易成本本身是一个负数值，在假设中提到的交易成本指的是其绝对值。本文应用了结构方程模型以及从江苏，山东和河南省取得 350 份来自于猪肉涂在加工企业的数据来验证这七个假设。

基于结构方程模型及其检验结果，本文提出的七个假设都通过了检验。在此基础上本文得出一些相关的结论。

本文研究发现，治理结构的选择并不仅仅取决于交易成本，它同时也取决于交易所得。产业链成员间建立更紧密和更稳定的治理方式是出于降低交易成本的需要，同时也受交易所得最大化的驱使。交易所得在本文中被定义为产业链成员通过交易（相互活动）取得的共同价值。这个价值是双方（多方）通过交易而取

得的共同改进。包括在物流系统的共建上的改进，资金回收上的改进，信息交换上的改进，技术和创新上的改进以及质量管理上的改进等等。需要强调的是，正如交易成本不包括企业的生产成本一样，本文中的交易所得并不包括交易双方通过合作在各自企业财务利润上取得的增值。产业链治理结构的选择是交易成本和交易所得共同作用的结果。产业链成员采用紧密而稳定的交易方式来降低交易成本和提高交易所得。

在中国猪肉产业链中，现货市场型的交易方式主导着生猪养殖户和屠宰加工商之间的治理结构。尤其是对于小型的养殖户和中小型的屠宰加工商而言，他们之间以熟人关系的方式链接，并没有很高的交易成本或较高的期望的交易所得。他们之间不正式的，邻里的关系相对稳定，采用松散的现货市场型的交易方式恰恰是符合其实际需要的。

然而，随着大中型商业化养殖和屠宰加工产业的迅速发展，大中型屠宰加工企业在与为数众多而分散的小型养殖户发生交易时便产生了困难。小型养殖户与大中型屠宰加工企业交易的过程中，其隐瞒信息和敲竹杠行为导致了双方交易成本的增加。大中型屠宰加工企业需要采用更为紧密和稳定的治理方式以降低他们与小型养殖户之间的交易成本，谋求更多的交易所得。通过这样治理结构的选择和变更，两者的交易所得有所增加，表现在质量所得方面就是，通过合作，大中型屠宰加工企业可以为终端消费者提供质量更好和更安全猪肉产品。

研究也验证了威廉姆森在交易成本经济学中的观点，即交易成本受到不确定性和资产专用性的影响。在中国猪肉产业链中，行为不确定性主要是由众多小型的家庭型养殖户的敲竹杠行为引起的；而大型屠宰加工企业具有较强的资产专用性，这使其交易成本增加。

另一方面，交易所得则受到产业链成员间的合作意愿和产业链成员的合作能力影响。日渐兴起的大型屠宰加工企业有着更强烈的愿意去了解在链上的其他成员并努力与他们进行合作。同时，他们也更有能力利用他们的资源在与其他成员的合作过程中创造更多的共有价值。也正因如此，在中国的猪肉产业链里，他们是促使产业链成员采用更加紧密和稳定治理结构的主要力量。

在研究结论的基础上，论文对猪肉产业链成员，猪肉产业部门的监管方提出几方面的建议如下。

第一，中国政府对西班牙猪肉的质量和安全给予了较高的关注，这使得双方的猪肉贸易难以达，两国之间需要建立更为紧密而稳定的贸易关系。同时，双方需要付出努力以达到足够并有效的信息沟通来打破贸易壁垒。另外，西班牙的猪肉出口企业应当对其出口中国的猪肉产品合理定价以赢取中国猪肉市场。

第二，虽然目前中国的猪肉产业链治理主导模式仍为现货市场，但在中长期内，主导模式即将并正在向更紧密，更稳定的治理结构，如纵向整合，合作社，养殖基地与企业的一体化的方向发展，现货市场的方式将逐渐被取代。

第三，除了产业链成员选择和变更治理方式来降低交易成本之外，猪肉产业的监管部门应当通过政策手段保持产业环境的稳定，降低市场交易风险。这样可以降低产业链成员的交易成本。同时，监管部门应当给予猪肉产业的大型龙头企业一定的资金，技术和政策支持，因为他们是促进产业链治理结构变革，带动众多小型而分散的企业进行产业整合的主要力量。

最后，大中型猪肉加工企业应当充分利用其自身的技术，信息，声誉，资金和人力等资源优势加强与产业链其他成员之间的合作，带动整个产业链交易所得的共同实现。

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1. Introduction

1.1 Introduction

China is the biggest pork producer and consumer in the world; and Spain is the second largest pork producer in Europe. Pork sectors are important in the two countries respectively, contributing more than 10% of the final agricultural production.

However, a severe problem of China´s pork industry is pork safety and quality. From 1998 to 2008, 19 pork quality and safety incidents happened in China, the so called “black-hearted” pork incidents happened every year covering big cities such as Shanghai, Beijing and provinces such as *Canton*, *Jiangsu*, *Zhejiang*, *Henan*, *Sichuan* and *Anhui*, etc., which draws great concern of Chinese consumers and policy makers. On the other hand, Spanish pork products have high safety and quality level. Spanish ham (*jamón*) enjoys a good reputation in the national and international market. Through the comparison of pork chain and pork chain management in China and Spain, it is found that there are various differences in these two chains, and the most significant difference is the governance structure mechanism of the chains. It is found that 80% of China’s pig producers are back-yard producers in a small-scale conducting spot market with their up-stream feed producers or down-stream slaughterhouse and processing industries. On the contrary, 80% of the Spanish pork chain agents conduct horizontal or vertical integration with their chain partners.

Supply chain management is a systematic approach to viewing the supply chains as a whole, and to manage the total flow of goods inventory from the supplier to the ultimate customer. It includes the bi-directional flow of products (materials and services), information, and the associated managerial and operational activities. Governance structure of the chain is defined as consists of a collection of rules/ institutions/constraints structuring the transactions between the various stakeholders (Hendrikse, 2003). Governance structure study is one of the key themes in supply chain management and it draws interests of researchers as it is closely related with quality management of the chain, firm and chain performance (Han, 2011), chain responsiveness (Handfield and Bechtel, 2002), etc. it has been proven by recent studies in quality management that at the chain level, supply chain integration has a

direct effect on quality management practices (Han, 2010). Van Plaggenhoef (2007) indicated that in meat, fruit and vegetables chains, integration has a significant relationship with quality performance. In China's pork industry, it has proven that closer organizational management mode positively contributes to pork quality and safety (Ji, 2008). Therefore, researchers try to find how and why chain agents connect with each other, what governance structure they choose. This research attempts to study the governance structure in pork chains in China and Spain respectively to find the differences and to explore the empirical governance structure choices process in China´s pork chain.

On one hand, spot market relationship dominates the governance structure in China´s pork chain. On the other hand, large scale slaughtering and processing industries are conducting governance structure reforms. They are applying long-term contract, owned production base, cooperatives and integrations with their up-stream chain agents. In traditional new institutional economics, it is assumed that organization's choices of the chain are mainly due to the transaction partners´ intension to reduce the transaction cost. Through the literature review and observation of the real situation of China´s pork chain, the author proposed that governance structure choices of the chain are the joint effect of transaction cost and collaboration advantages, which means that transaction partners to pursue joint value meanwhile they try to decrease the transaction cost, and this joint value also influences the final governance structure choice.

This research tries to explain and empirically demonstrate why and how these choices happen from combined perspectives of transaction cost, collaboration advantages and resource-based view applying SEM model and using data collected in China´s pork chain. Based on this, the factors that influence transaction cost and collaboration advantages are also explored.

With China´s pork market open to Spain in 2007, the international trade of pork between the two countries is increasing. However, the quantity of trade is not large compared to other pork exported countries to China. The research gives an analysis on this international pork chain from perspectives of structure of the chain, information exchange, and quality management system and value chain analysis to identify problems and to give suggestions.

Through the studies on Spanish-Chinese international pork chain, the research gives insights on international trade and know-hows in international trade. It also helped in establishing international cooperation academically and commercially.

1.2 Research questions and objectives

The first question of the research is:

> *RQ 1: What are the differences of pork chain and pork chain management between China and Spain and what are mostly differently in these perspectives between the two countries?*

As introduced in part 1.1, pork industry is of great importance both in China and Spain while this industry in two countries has different features while the pork safety and quality situation in China draws special attention. The differences come from each link of the chain.

The second question is:

> *RQ 2: Why the international trade of pork between Spain and China is not smooth, and what are the possible solutions from chain perspective?*

From 2007, China opened the pork trade market to Spain. It was expected that the Spanish pork products enter China´s market smoothly and Spanish products succeed China´s market, but the performance of Spanish pork products is not satisfactory though it has good quality and reputation in European market. Until February of 2011, only 18 Spanish companies have achieved official approval to access China´s pork market and most of them could export offal.

The research has the third question, which is:

> *RQ 3: Why the large slaughtering and processing industries are taking the reform of governance structures in pork chain in China?*

China´s pork industry is undergoing great exchanges. Large-scale productions are taking over the small backyard pig production. Commercial slaughtering and processing are gaining importance, and they are conducting governance structure

changes in the whole industry. New forms of governance structure such as the company plus production base, cooperatives, integrations are emerging. Then the third question is:

With these research questions, the research objectives are stated as follows:

1. To identify differences of pork chain and pork chain management in China and Spain.

2. To find problems of the international pork chain between Spain and China and to give solutions to these problems.

3. To demonstrate governance structure choices process empirically using the data of China´s pork chain from transaction cost and collaboration advantages aspects.

4. To search the factors that influence transaction cost and collaboration advantages.

1.3 Social-Economic research domain

The study chooses pork chains in China and Spain as the research domain as the author was doing the European project ¨Q-pork chains¨ in China and later was collaborated with this project in Spain. China´s pork chain is a typical pork chain in developing countries featuring that small scaled pig producers dominate industry pig production while Spain´s pork chain is different with large-scale commercial production and industrial processing. Comparisons of the two chains generate their differences thus inspire further studies. Therefore, one of the main content of the research is a comparative study on pork chain and pork chain management in China and Spain, which is analyzed in chapter three. Chapter three is divided into two parts, which are pork chain comparisons and comparisons in pork chain management. Based on the theoretical review on supply chain and supply chain management, the author generates the outline of the comparison of pork chain and pork chain management between Spain and China. In pork chain comparison, each link of the pork chain in Spain and in China is compared, including the introduction in pork chain industry, feed production, pig production, pig slaughtering and pork processing, pork distribution and marketing, pork consuming and pork international trade. In comparisons in pork chain management, the two domestic chains are compared through description of the chain, governance of the chain,

information use and exchange, logistics system regulations of the chain.

As introduced in part 1.1, the pork trade between Spain and China is another focus of this research. Chapter four gives a study of this focus from the international chain perspective. Thus, one of the research domains is the international pork chain study between Spain and China. It is stated by structure of the chain, governance of the chain, information exchange, quality management system and imported pork price issues.

Based on the comparisons on pork chains in two countries, it is found that the governance structure is main difference and governance structure choice is another focus of this research. With the financial support of National Natural Science Foundation Project "*Research about Influence of Implementing Supply Chain Management on Ensuring the Supply of Safe Pork (No. 70973053/G0305)*" in China, the author conducted empirical governance structure study in China´s pork chain, which is chapter 5. First, the author reviews theories related with governance structure choice of the chain, including transaction cost, transaction value analysis (strategic choices) and resource-based view. Then seven hypotheses are generated. Later on SEM model is introduced, and conceptual model is established accordingly. In the following, data collected in *Jiangsu*, *Shandong* and *Henan* Provinces in China are applied into the model operation, and the model results empirically proved the hypotheses proposed.

1.4 Research method

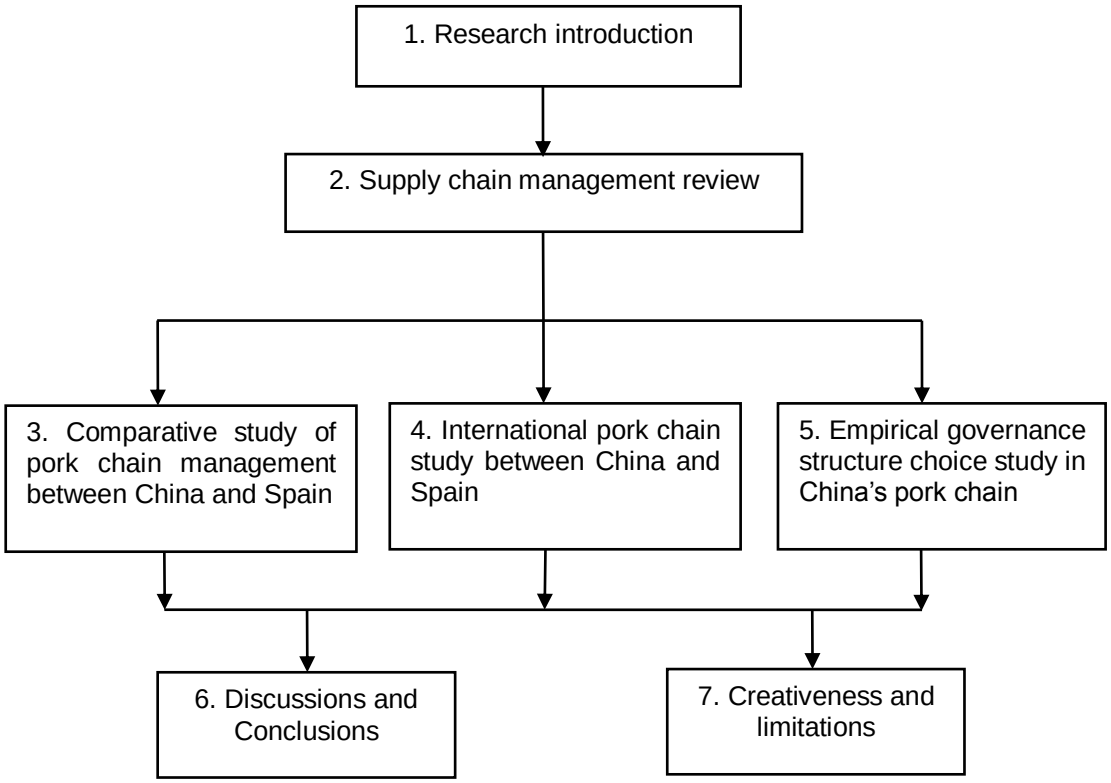
Different research methods are adapted according to each main contents of the research. The mostly used method of this research is social survey and investigation, which run through almost the whole study. They are put into use of comparative studies, international chain studies between China and Spain and governance structure choice study in China´s pork chain. Professionals and experts from Spain and China in pork industries are interviewed and investigated. Large scale of investigation is conducted, and a strong first hand data resource is obtained for the deduction chapter 5. On the other hand, comparative analysis is applied in comparisons of pork chain and pork chain management in Spain and China. Second hand data are also utilized.

Chapter 1

1.5 Outline of the thesis

Figure 1 describes the outline of the thesis. Chapter one is research introduction, which introduces the research background, research questions, research domain and research methods in order to give the outline of the thesis. Chapter 2 is the theoretical review on supply chain management which gives the framework for comparative study and international chain study. It introduces the study from governance, information use and exchange, logistics systems, laws and regulations of the chain and value chain analysis. Chapter three is a comparative study of pork chain and pork chains management between China and Spain, including pork chain comparison and pork chain management comparison according to the framework of chapter two. Chapter four is international chain studies with regard to the pork trade between Spain and China. Chapter five is an empirical study on governance structure choices in China's pork chain. Finally, the thesis gives the discussions and conclusions based on the whole analysis. It also gives the creativeness and limitations of the study.

Figure 1. Outline of the thesis



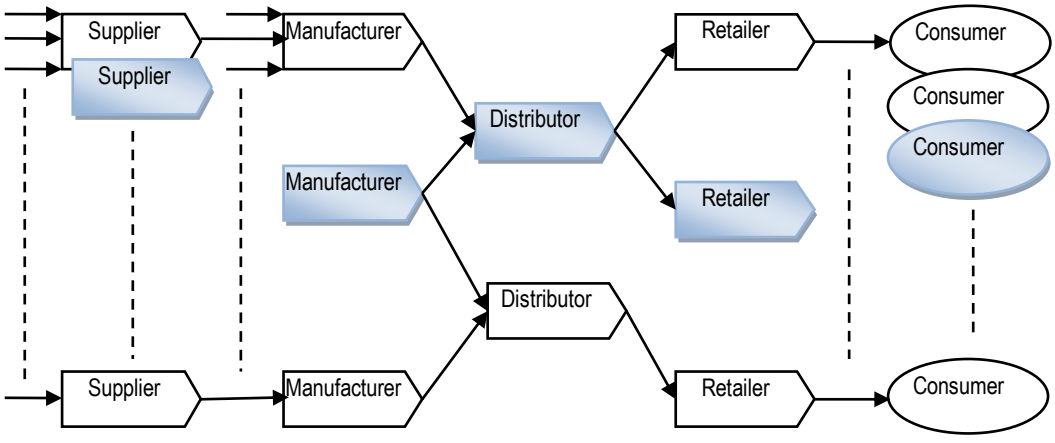
2. Literatures on Supply Chain Management

2.1 Supply Chain and Supply Chain Management definitions

The terms Supply Chains (SC) and Supply Chain Management (SCM) were originally introduced by consultants in the early 1980s in logistics literature as an inventory management approach with an emphasis on the supply of raw materials (Oliver and Webber, 1982) and subsequently received tremendous attention.

Supply chain is defined as a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer (Mentzer et al., 2001). It not only includes the manufacturer and its suppliers, but also (depending on the logistics flows) transporters, warehouses, retailers, and consumers themselves (Van der Vorst, 2004). It includes, but is not limited to, new-product development, marketing, operations, distribution, finance, and customer service (Chopra and Meindl, 2007). Van der Vorst (2000) depicted a generic supply chain within the context of the total supply chain network with is demonstrated in figure 2. Each firm belongs to at least one supply chain.

Figure 2. Schematic diagram of a supply chain (shaded) within the total supply chain network



Source: Van der Vorst, 2000.

Chapter 2

The concept of Supply Chain Management was mainly used to discuss the benefits of integrating a firm´s internal business functions, such as purchasing, manufacturing, sales, and distribution (Harland, 1996).

SCM emerges from the transportation and logistics literature of the wholesaling and retailing industry, emphasizing the importance of physical distribution and integrated logistics. Houlihan (1983) described SCM as the ¨modern approach to logistics¨, which is integration of the various functional areas within an organization to enhance the how of goods from immediate strategic suppliers through manufacturing and distribution chain to the end user (Houlihan, 1987, 1988). However, the definitions of SCM and logistics have been clearly distinct. Logistics is that part of supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point-of-origin to the point-of-consumption in order to meet customers´ requirements (Lambert and Cooper, 2000). In other words, the scope of SCM is widened from having an intra-organizational focus on logistics to becoming focused on inter-organizational issues (Cooper et al., 1997) including ¨all key processes and functions¨ (Dubois et al., 2004; Mentzer et al., 2001). Different scholars have developed the definitions of SCM covering areas such as technology (Lee and Billington, 1992), information (Van der Vorst, 2000; Handfield and Bechtel, 2002), value created (GSCF, 1998), supply chain network structure (Cooper et al., 1997; Harland, 1996; Scott and Westbrook, 1991;) and logistics (Lee and Billington, 1992; Houlihan, 1987, 1988). The development of SCM definition is stated in table 1.

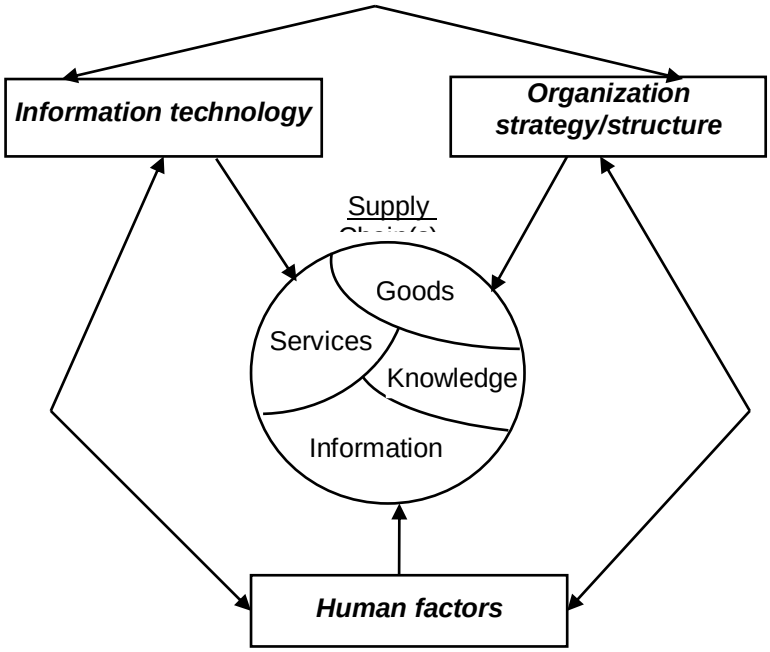
Table 1. Definitions of Supply Chain Management

Author(s)	Definition
Houlihan 1987, 1988	SCM is an integration of the various functional areas within an organization to enhance the how of goods from immediate strategic suppliers through manufacturing and distribution chain to the end user
Lee and Billington, 1992	Supply chain management focuses on how firms utilize their suppliers' processes, technology, and capability to enhance competitive advantage (Farley, 1997), and the coordination of the manufacturing, logistics, and materials management functions within an organization.
Cooper et al., 1997	SCM spans the entire chain from primary producer to ultimate consumer that evolves through several stages of increasing inter-firm integration and coordination.
Monczka, Trent and Handfield, 1998	SCM requires traditionally separate materials functions to report to an executive responsible for coordinating the entire material process and also requires joint relationships with suppliers across multiple tiers. SCM is a concept, “whose primary objective is to integrate and manage the sourcing, flow, and control of materials using total systems perspective across multiple functions and multiple tiers of suppliers”.
Mentzer et al., 2001	Supply chain management raised by scholars and finally they define supply chain management as the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole.
Harland, 1996	Supply chain management as managing business activities and relationships (1) internally within an organization, (2) with immediate suppliers, (3) with "first and second-tier suppliers and customers along the supply chain, and (4) with the entire supply chain.
Van der Vorst, 2000	The ultimate goal of SCM is accurate information and a smooth, continual high quality product flow between partners to maximize buyers’ satisfaction
Handfield and Bechtel,2002	Supply chain encompasses all activities associated with the flow and transformation of goods from raw materials stage (extraction), through to the end user, as well as the associated information flows.
Scott and Westbrook, 1991	Supply chain management as the chain linking each element of the manufacturing and supply process from raw materials through to the end user, encompassing several organizational boundaries.

Author(s)	Definition
Global supply chain forum (GSCF, 1998)	Supply chain management is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders
Cooper and Ellram, 1993	SCM is an approach whereby the entire network, from suppliers through to the ultimate customers, is analyzed and managed in order to achieve the 'best' outcome for the whole system. It includes analyzing the level and location of SC inventories, managing information flows throughout the channel, and coordinating efforts to best meet the customer's needs
Lambert, 2007	Supply chain management is defined as "the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders."

Caddy and Helou (2007) spread SCM as supply chain systems as it is composed of components as people, flows, flows of physical goods, and flows of intangible services. From the perspective of purpose, supply chains improving the flow of goods, services and information from one organization to another. This argument indicates that supply chains are systems. They described the generic supply chain model as the following figure 3, which states that supply chain as a system.

Figure 3. Generic Supply Chain Model



Source: Caddy and Helou, 2007.

All these definitions suggest that the boundaries of SCM include not only logistics but also all other functions within a firm and within a supply chain. It encompasses the entire value chain and addresses materials and supply management from the extraction of raw materials to its end of useful life. Cooper et al. (1997) and Mentzer et al. (2001) gave the characteristics to SCM, and SCM actually is:

1. A systems approach to viewing the supply chains as a whole, and to managing the total flow of goods inventory from the supplier to the ultimate customer.
2. A strategic orientation toward cooperative efforts to synchronize and coverage intra-firm and inter-firm operational and strategic capabilities into a unified whole.
3. It includes the bi-directional flow of products (materials and services) and information, and the associated managerial and operational activities.
4. A customer focus to create unique and individual source of customer value with an appropriate use of resources, leading to customer satisfaction and building competitive chain advantages.

It indicates that SCM is about the co-ordination of managerial and operational activities of organizations connected in a SC to provide high customer value with an appropriate use of resources. Which is different from the traditional management concept, SCM focuses on the management of relationships. Cooper and Ellram (1993) make a distinction between traditional management and SCM (Table 2). Lambert and Cooper (2000) addressed that “one of the most significant paradigm shifts of modern business management is that individual business no longer competes as solely autonomous entities, but rather as supply chains. Instead of brand versus brand or store versus store, it is now supply chain versus supply chain”.

Table 2. Differences between traditional management and SCM

Element	Traditional Management	Supply Chain Management
Inventory management approach	Independent efforts	Joint reduction in channel inventories
Total cost approach	Minimize firm costs	Channel-wide cost efficiencies
Time horizon	Short-term	Long term
Amount of information sharing and monitoring	Limited to needs of current transactions	As required for planning and monitoring purposes
Amount of co-ordination of multiple levels in the channel	Single contact for the transaction between channel pairs	Multiple contacts between levels in firms and levels of channel
Joint planning Compatibility of corporate philosophies	Transaction-based Not relevant	On-going Compatible at least for key relationships
Breadth of supplier base	Large to increase competition and spread risk	Small to increase co-ordination
Channel leadership	Not needed	Needed for co-ordination focus
Amount of sharing of risks and rewards	Each on its own	Risks and rewards shared over the longer term
Speed of operations, information and inventory flows	'Warehouse' orientation (storage, safety stock). Interrupted by barriers to flows. Localized to channel pairs	'DC' orientation (turnover speed). Interconnecting flows; JIT, Quick Response across the channel

Source: Van der Vorst, 2000

2.2 Research Scope of Supply Chain Management

As we defined in the previous part, SCM is a comprehensive systematic concept. It consists of behaviors among various chain agents (members), processes of tangible and intangible flows of goods and services. The objectives of the chain are also varied. Therefore, SCM is a wild research field with all types of studies from different aspects. This part aims to clarify the SCM research scope by identifying its objectives, activities and management components.

With the reference of SCM definitions, it is concluded that the objectives of SCM are lowering the cost, improved customer value and satisfaction and gaining competitive advantage.

Mentzer et al. (2001) addressed SCM activities into seven fields:

- ***Integrated behavior***: this set of activities is a coordinated effort called supply chain management between supply chain partners, such as suppliers, carriers, and manufacturers, to dynamically respond to the needs of the end consumer (Greene, 1991).
- ***Mutually Sharing Information***. Opening sharing of information such as inventory levels, forecasts, sales promotion strategies, and marketing strategies reduces the uncertainty between supply partners and results in enhanced performance (Andel, 1997; Lewis and Talalayevsky, 1997; Lusch and Brown, 1996; Salcedo and Grackin, 2000).
- ***Mutually Sharing Risks and Rewards***. Effective SCM requires mutually sharing risks and rewards that yield a competitive advantage (Cooper and Ellram, 1993).
- ***Cooperation***. Cooperation refers to similar or complementary, coordinated activities performed by firms in a business relationship to produce superior mutual outcomes or singular outcomes that are mutually expected over time (Anderson and Narus, 1990). Cooperation starts with joint planning and ends with joint control activities to evaluate performance of the supply chain members, as well as the supply chain as a whole (Cooper et al, 1997; Ellram and Cooper, 1990; Novack, Langley and Rinehart, 1995; Spekman, 1988; Tyndall et al., 1998).
- ***Same Goal and the Same Focus on Serving Customers***. La Londe and Masters (1994) proposed that a supply chain succeeds if all the members of the supply chain have the same goal and the same focus on serving customers.
- ***Integration of Process***. The implementation of SCM needs the integration of processes from sourcing, to manufacturing, and to distribution across the supply chain (Cooper et al, 1997; Cooper, Lambert and Pagh, 1997; Ellram and Cooper, 1990; Novack, Langley and Rinehart, 1995; Tyndall et al., 1998).
- ***Partners to Build and Maintain Long-term Relationships***. Effective SCM is made up of a series of partnership and, thus, SCM requires partners to build and maintain a long term relationship (Cooper et al., 1997; Cooper, Lambert and Pagh, 1997; Tyndall et al., 1998).

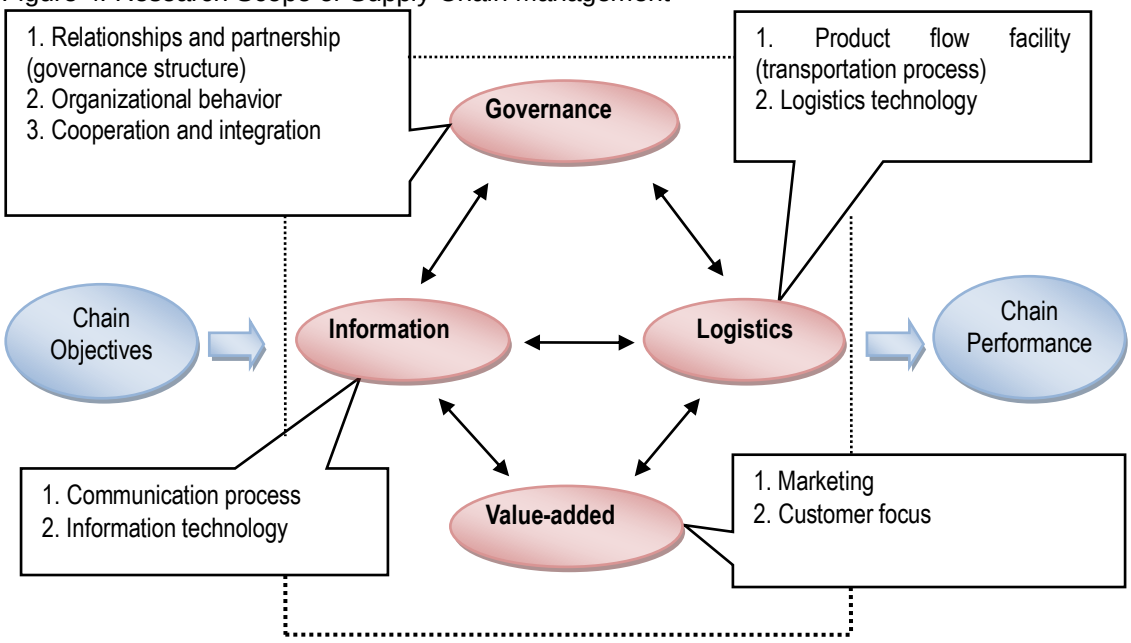
Robinson and Malhotra (2005) summarized the principal components of supply chain management as strategic management, relationships and partnerships, supply base

integration, best practices, organizational behavior, continuous improvement and learning, marketing and transportation and logistics.

Lambert and Cooper (2000) classified the management components of SCM as Physical & Technical Management Components and Managerial & Behavioral Management Components. Physical &Technical Management Components include planning and control methods, work flow/activity structure, organization structure, communication and information flow facility structure and product flow facility structure. Managerial & Behavioral Management Components include management methods, power and leadership structure, risk and reward structure and culture and attitude.

Based on review of these points, it is summarized that the scope of SCM could be divided into main four issues, which are governance issues, information issues, and logistics issues and value created issues. The four issues have several research focuses, and they influence each other. The research scope of SCM is stated in figure 4.

Figure 4. Research Scope of Supply Chain Management



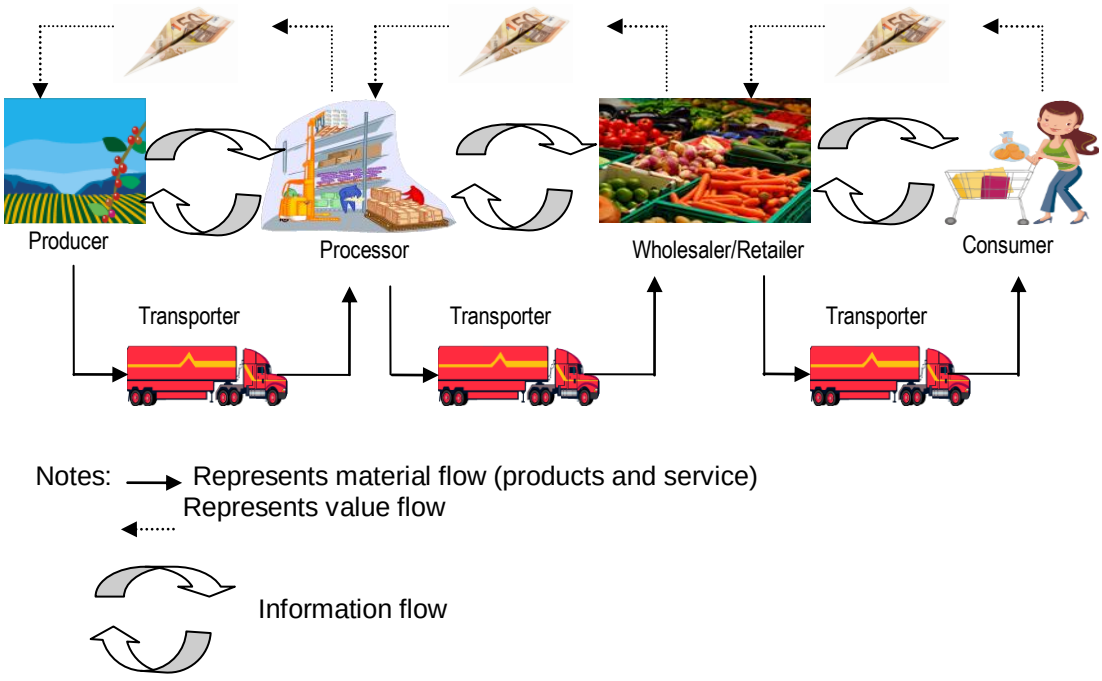
Source: drawn by the author.

This research scope is the study framework of chapter 3 and chapter 4. Chapter 5 will focus on empirical study of governance structure of the chain.

2.3 Food chain and food chain management

Food Chain Management (FCM) is the application of supply chain management in the food sector. It is the ¨from field to table¨ management through the whole agri-food chain, including food production, processing, and distribution until consumption. It manages the tangible flow and intangible flows, which are material (product and service) flow (logistics flow), information flow, and value flow (see figure 5). Apart of these cross-border flows, the food industry is becoming an interconnected system with a large variety of complex relationships, reflected in the market place by the formation of food chains via alliances, horizontal and vertical cooperation, forward and backward integration in the supply chain and continuous innovation (Van der Vorst, 2006), which refers to governance structures of food chains what we will give focus in chapter 4.

Figure 5. Agri-food chain management



Source: drawn by the author

Food chains undergo greater uncertainty compared with other supply chains due to the particular characteristic of agricultural products' perishability. Food product's perishability creates uncertainty for the buyer with respect to product quality, safety and reliability (i.e. quantity) of supply. It also creates uncertainty for the seller in locating a buyer, as perishable products must be moved promptly to the marketplace to avoid deterioration, leaving sellers unable to store the products awaiting favorable

market conditions. Moreover, food products usually exhibit high seasonality in raw materials' availability and in end-products demand. This uncertainty requires the food chain to manage several points to keep its performance a success, which are: 1) flexibility and speed to adapt to the changing conditions and scenarios; 2) integration of small producers; 3) risk control (including the risk in production, transportation and storage, marketing, financing, consumer´s demand etc.); 4) innovation in production, organization (internal processes, logistics, and marketing), and management. 5) coordination of macro and micro food policies; 6) food market stability; 7) trust, traceability and guarantees in business to business and business to consumers relationships; 8) Ethics, fair trade and balancing of interests. Food Chain Management (FCM) seeks to find the optimal balance in considering requirements on economic efficiency, environmental control, process organization, food safety, market and transaction rules, etc.

Trienekens et al. (2008) address that the focus of food chain management is explicitly on finding the most effective and efficient way of adding value with the aim of meeting consumer requirements effectively and at minimal costs. In simple terms, chain management is concerned with the sharing of information in order to:

- Reducing uncertainty and risk

  Unpredictable changes in demand and supply are a major source of inefficiency in procurement, production, marketing and logistics. The growing concerns over food safety have increased the need for traceability and quality assurance throughout the entire food chain.
- Save time

  Markets across the world are becoming increasingly dynamic and Product Life Cycle are getting shorter, thus requiring increased flexibility and responses.
- Reduce costs

  Timely and reliable information from chain partners improves manufacturing efficiency, reduces inventory, improves distribution effectiveness and eliminates waste.
- Increase effectiveness

  Knowing what the consumer wants makes it possible – together with chain partners – to accurately target consumer needs and wants
- Add value

  Innovation in new product development and customer service remains the only sustainable source of competitive advantage that is difficult to achieve, but also more difficult to be copied.

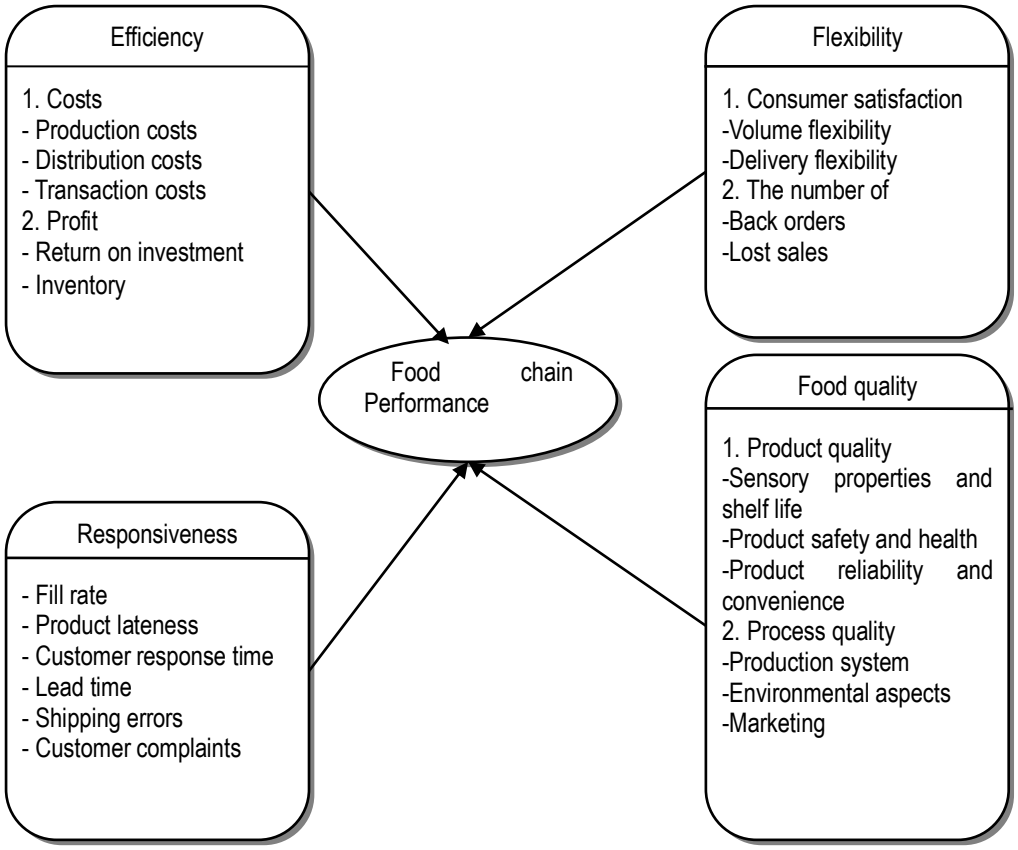
- Improve quality
  Visibility of quality differences in chains contributes to incentives to improve

Briz and De Felipe (2006) summarized “8C” in European Union agri-chains, which are eight important points that show the situation and trend of agri-chains. The eight points are:

- Change in the commercial chain
- Changes in technologies and structures of the chain
- Crisis in the actual models (PAC, protectionism)
- Competence in business
- Consuming and preoccupation hygiene
- Conservation in environment
- Convergence to globalization
- Compatibility with social-economic development

The performance of the food chain depends on the performance of individual enterprises, the quality and efficiency of interactions between the stakeholders in the chain and networks, the influence of natural, economic, competitive, legal, cultural, social, scientific and technological environments, and the behavior and expectations of consumers. The food sector builds on a complex infrastructure of food chains and networks involving suppliers, primary producers, processors and manufacturers, retailers and consumers as the final customers. Both financial and non-financial (technical, logistic, environmental, social) performance indicators are necessary in measuring the performance of food supply chains, non-financial measures such as freshness, food safety etc. is important in agri-food supply chain management. Considering these factors, Aranmyan (2007) describes the indicators that affect performance of an agri-food chain, which are efficiency, flexibility, responsiveness and quality (see figure 6).

Figure 6. Conceptual framework of food chain performance indicators

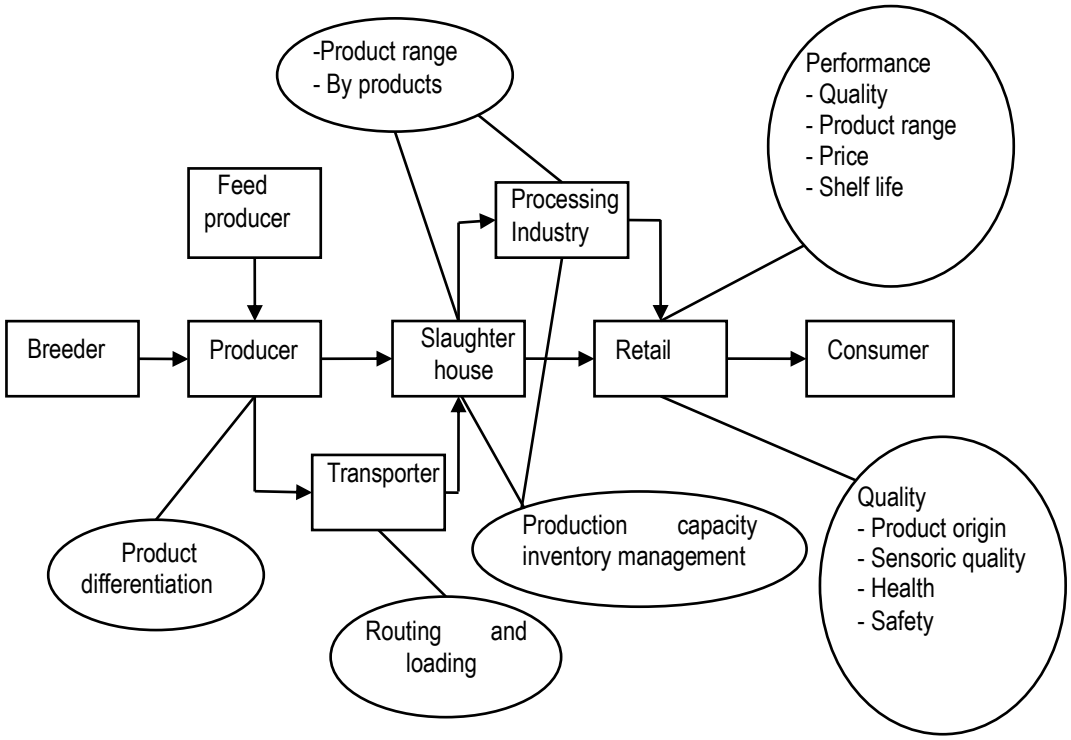


Source: Aranmyan (2007)

2.4 Pork chain and pork chain management

Pork chain is a whole process that spans from feed producing of pigs, breeding, farrowing, finishing, slaughtering, processing, to distribution until the end consumer (see figure 7), pork chain management aims to provide the consumers pork products with satisfaction through making the chain performance better by managing the governance, information flow, quality management, cash flow, etc.

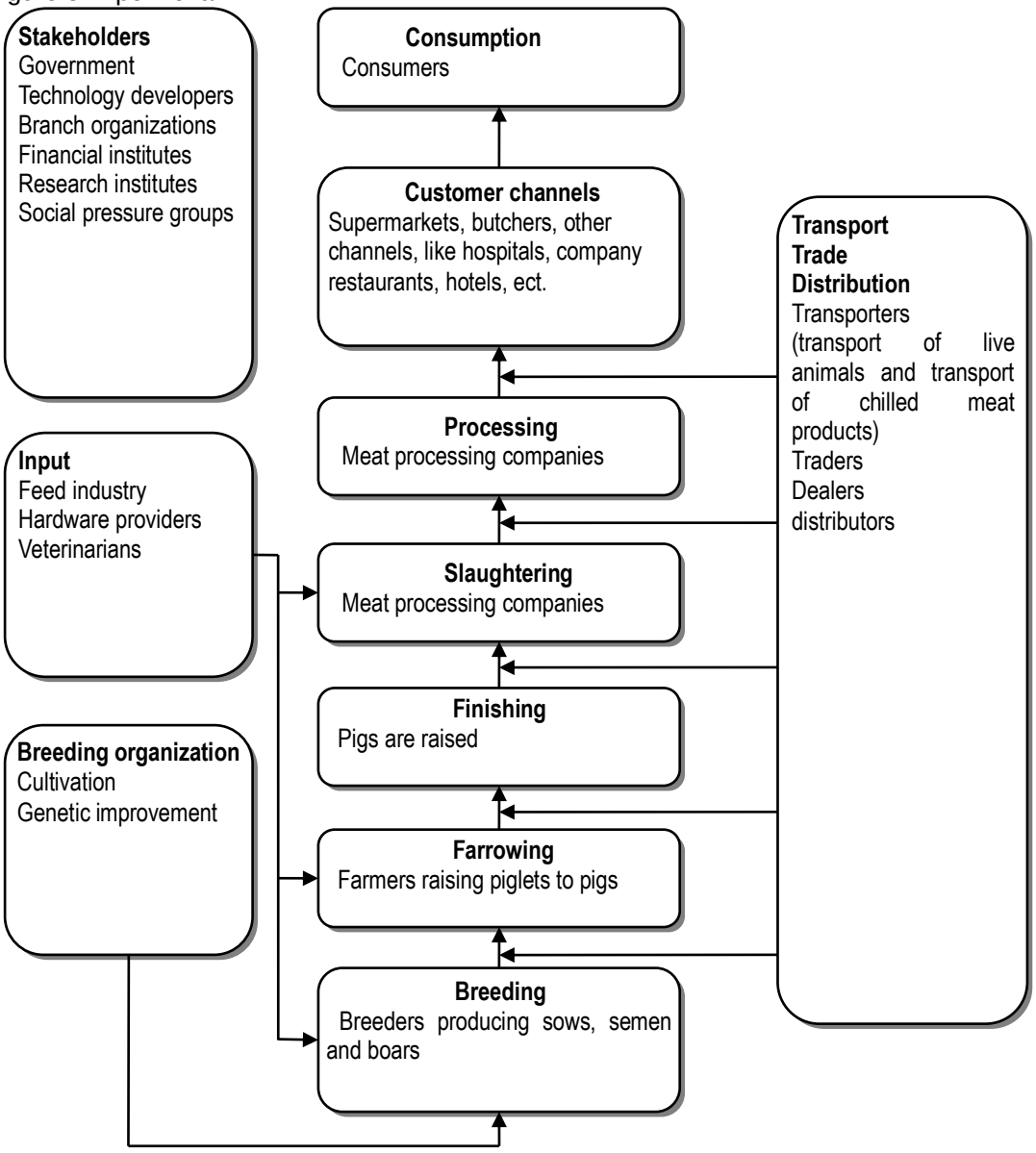
Figure 7. Fields of attention in the pork chain from economic perspective



Source: Trienekens et al., 2008

As it is said in the supply chain management part, one of the objectives of supply chain management is to achieve consumers' satisfaction and establish the competitive advantage for the companies. Successful chains nowadays are more market-oriented, and operate with the ultimate goal of responding to changing consumer demands. An efficient pork chain should provide the consumers increasing interests in pre-packed, convenience, ready-to-eat, healthy and safe food products. The "economic" fields of attention in various stages in the pork chain are showed in figure 7.

Figure 8. A pork chain



Source: Trienekens et al., 2008

Studies have been done on pork chain's management from different aspects, and thus various conclusions have been generated. Some important studies and their generations have been stated as follows:

Den Ouden et al. (1996) gave a research on vertical cooperation in agricultural production-marketing chains with special reference to product differentiation in pork. It is concluded that vertical cooperation seems to be more appropriate for improving vertical coordination in agricultural production marketing chains than complete vertical integration in the case of pig productions systems in the Netherlands.

Schulze et al. (2007) studied the vertical coordination in German pork production, and they concluded that reflections on TCE indicate the long-term viability of slaughter pig markets with a low degree of vertical coordination, which may have efficiency advantages over more integrated meat supply chains. Trust management can be considered a suitable instrument for gaining some of the advantages usually attributed to contracts. Trust-building instruments should be integrated into a broader approach of supplier relationship management.

Van der Gaag et al. (2004) gave a research on the spread of Salmonella in the pork supply chain from the food safety perspective, and they found that the finishing stage and the slaughterhouse appeared to be the most important stages in the supply chain to reduce the prevalence of Salmonella contaminated carcasses.

Deimel et al. (2008) studied the transparency in food supply chains empirically from the case of German pig and dairy production, and the study suggests that a high number of food safety incidents stemming from fraudulent behavior and a lack of consumer trust, and the meat industry is one of the least transparent agri-food chains and that other chains have an advantage over the meat chain with regard to transparency.

Wever et al. (2010) researched on alignment between chain quality management and chain governance in European Union pork supply chains. The case-study results show that four different types of systems can be distinguished for coordinating quality management in EU pork supply chains. The patterns found between quality management systems and governance structures in the examined cases indicate that transaction-cost-economic considerations explain quality management systems choices. This supports the view that alignment between quality management systems and governance structures is important for the efficient coordination of quality management in (meat) supply chains.

Han et al. (2009) studied the relationship and quality management in the Chinese pork supply chain. The empirical results provide managers of pork processing firms with an insight to use relational governance appropriately for managing pork supply chains under uncertainty and with asset specific investments. The research findings show the importance of both transactions attributes in determining long-term oriented inter- firm collaborative relationships. The positive relationship between vertical integration and quality management systems is proven and thus it is important for managers to opt for

appropriate governance arrangements to ensure quality management in the pork chain. Han et al. (2010) studied the moderating role of competitive strategy in relating firm performance to quality management and government support, and they concluded that the financial and technological support from government authorities has a significant impact on firm performance of pork processors.

2.5 Chapter summary

From the literature review of supply chain and supply chain management, food chain management and pork chain management, several conclusions were drawn as follows:

First, Supply Chain Management is a systems approach to viewing the supply chains as a whole, and to manage the total flow of goods inventory from the supplier to the ultimate customer aiming to meet customer satisfaction and build competitive chain advantages. The research framework could be divided into four aspects, which are: information, governance, logistics and value added of the chain.

Second, food industry undergoes greater uncertainty and thus bears more risks compared to other industries due to the specific perishable characteristics of agricultural products. Food chain management is the application of SCM in agricultural industry which helps reduce risks and uncertainty, reduce costs, save time, increase efficiency and effectiveness, increase agri-food value added through the chain and improve agri-food safety and quality.

Third, studies on pork chain and pork chain management are varied in different aspects, mainly focusing on governance, pork safety and public policies. From these studies, we find that the governance of pork chain draws more interest and important in pork chain management as it closely related with pork quality and safety management systems. As the same time, the governance structure choice differs in countries and studies, a definitive conclusion on the governance structure that the pork chain should choose does not exist, and it calls great discussion.

Based on all these revisions, the following study will first compare the differences of pork chain and pork chain management according to the SCM research framework from the information, governance, logistics and value added aspects. And then it will study the governance choice through analyzing the governance structure

performance in China´s pork chain empirically, trying to give theoretical and managerial contributions to the governance studies in Supply Chain Management.

3. Domestic pork chains analysis

3.1 Study objectives

The objective of this study is to identify the differences of pork chain and pork chain management in Spain and China, giving a focus to food safety and quality through a comparative study between China and Spain. Through the comparison, the key element of supply chain management to ensure pork safety will be found and thus be given detailed analysis in the following empirical part. Finally it gives suggestions to the Chinese stakeholders of the pork chain to improve their performance from SCM perspective.

3.2 Pork chain in China and Spain

3.2.1 Introduction of pork sector

-China

China is the largest pork production and consumption country. Since 1972, the pork output of China has always been the 1st in the world. In 2008, the pork output was 47.2081 million tons, accounting for 45.7% of the world pork output (FAO, 2008). During the 30 years from 1978 to 2008, the pork production has increased 5 times. Pork production accounts for around 60% of China's total meat. In recent 10 years, though the productions of beef, mutton and poultry are increasing, pork production still accounts for the biggest part of meat production.

Pork is popularly consumed in China，the total consumption of pork in 2009 was 48.79 million tons. The consumption per capita was 18.21kg in urban area and 13.7 kg in rural area in 2008 in China.

[1] FAO 2009

Meanwhile, the pork industry is an important source of the farmers' income in China. From the macro view, the development of China's pork industry has a great influence on promoting the economy, balancing the supply and demand of agricultural products, and adjusting fiscal subsidiary and taxation.

From 2007, the price of fresh pork in China is increasing; the price of fresh pork in March of 2008 was 2.5 Euros per kilo with an increase of 77.2% compared with price of pork of the same period in 2007, which was 1.45 Euros per kilo. This increase came from several reasons, which were influenced by cyclical price change, the epidemic disease prevailed in 2006 and the increase in cost of feed.

However, on one hand, pork sector is of great importance in agricultural sector in China, on the other hand, severe pork safety problems exist.

-Spain

Spain is the fourth pork producer in the world and the second pork producer in Europe. It produces an average of 3.5 million tons pork per year, 36% of which goes to export. In 2008, the production of meat was 5.76 million tons, in which pork production was 3.48 million tons, accounting for 60% of the meat production. Between 2000 and 2008, the production of pork has increased 20% in Spain, and *Cataluña* is the biggest pork producer in Spain with 39% of the total production, following *Castilla y León* with 14% and *Castilla La Mancha* with 9%.

In Spain, more than 55% of the pork consumption is fresh pork. The percentages are 69% in *Cataluña*, 74 in *Castilla La Mancha*, 51% in *Andalucía*, 54% in *Aragón* and 66% in *Murcia* respectively. In *Castilla y León* and *Extremadura*, 80% and 74% of the pork production go to industry process (*Ministerio de Medio Ambiente y Medio rural y Marino, MARM, 2009*). The following table 3 shows the top 20 companies in meat sector in Spain in 2007.

Table 3. Top 20 companies in meat sector in Spain (Million €)

Nº	Enterprise	Workers	Own resources	Sales 06	Sales 07	% 07/06
1	Corporación alimentaria Guissona, S. A.	2,837	209.947	841.98	980.62	16.5
2	Campofrío Alimentación, S. A. (Grupo)	5,198	314.049	864.55	968.46	12.0
3	El Pozo alimentación, S. A.	3,391	7.212	499.93	550.00	10.0
4	Casa Tarradellas, S. A.	1,280	1.803	470.00	510.00	8.5
5	Martinez Loriente, S. A	1,455	42.447	387.40	446.46	15.2
6	Incarlopsa –Ind, Carnicas, Loriente Piqueras	850	1.522	350.00	416.00	18.9
7	Coop. Ganadera Valle de los Pedroches	564	88.772	229.30	266.95	16.4
8	Jorge, S.L. (Grupo Samper)	295	71.830	199.69	221.20	10.8
9	S.A.T. Fribin, Industria cárnica	434	32.260	198.91	210.16	5.7
10	Industrias cárnicas vilaro, S.A.	350	3.337	185.16	200.00	8.0
11	Carniques de Juia, S.A.	280	19.200	167.60	166.62	-0.6
12	Grupo Alimentario Argal, S.A.	786	49.723	148.00	163.00	10.1
13	Frigolouro S.A. (Ind. Frigor. Louro)	570	17.291	142.34	143.78	1.0
14	Frimancha Industrias Cárnicas, S.A.	158	24.500	143.90	138.28	-3.9
15	Rivasam CIA.Int.Prod. Alimenticios, SA.	327	0.060	121.24	131.00	8.1
16	Fabr. Matadero y despiece (Famadesa)	330	0.721	130.16	129.25	-0.7
17	Patel, S.A.	170	0.636	134.61	128.50	-4.5
18	Frig. Andaluces de conservas de carne, S.A.	28	0.391	105.70	124.58	17.9
19	Noel Alimentaria, S.A.	490	2.391	106.69	122.40	11.6
20	Carnica Batalle, S.A.	235	0.433	117.26	120.00	2.3

Source: Alimarket, 2008

3.2.2 Feed production industry

- China

China is the second feed producer in the world after United States. The whole feed industry in China has undergone great changes. Now it is led by several big companies instead of being dominated by many small and scattered companies, the biggest 13 feed companies account for one third of the production of the whole industry1. But there are still many problems existing such as the safety, fluctuation in the price of raw materials of feed and lack of innovation in the industry. The large-scale companies are *Zhengda*, New Hope and *Tongwei*, among which New Hope is the fourth biggest feed producer in the world in 2008[2] (See table 4).

- Spain

Spain is the second feed producer in European countries, and its feed industry is dominated by several big international companies such as *Cargill España, S.A*, *Nanta,*

[1] The development situation of Chinese feed industry http://feed.aweb.com.cn/zt/972/index.shtml
[2] The analysis of the feed market in the world http://feed.aweb.com.cn/zt/969/index.shtml

S.A and national companies such as *Coren* and *Guissona*[1]. Feed industry in Spain also has problems of price fluctuation, which influences pork price a lot. In the Spanish pork chain, big feed companies are also big integrators who integrate with pig producers.

Table 4. Top 10 feed producers in the world in 2008

Ranking	Company	Country	Productivity (million ton)
1	Charoen Pokphand (CP group)	Thailand	21.5
2	Cargill/Agribrands	USA	17.1
3	Land' O Lakes Purina	USA	12
4	New Hope Group	China	11
5	Tyson Foods	USA	10.1
6	Nutreco	Netherlands	8.9
7	Zen-Noh Co-operative	Japan	7.4
8	East-Hope Group	China	5.5
9	Sadia	Brazil	5.4
10	Perdigao	Brazil	4.8

Source: Li, 2009

3.2.3 Pig production

-China

As it is said before, China is the biggest pork production country in the world; table 5 shows the top 10 pork production countries in the world.

Table 5. Top 10 pork production countries in the world (unit million ton)

Year	2007		2002		1997		1992	
	Output	percentage	Output	percentage	Output	percentage	Output	percentage
China	**43951178**	**44.3**	**42322776**	**45.47**	**37156348**	**44.6**	**27647184**	**37.2**
U.S.A	9952709	10.03	8929000	9.59	7835000	9.4	7817000	1.05
Germany	4985177	5.02	4110155	4.42	3563800	4.27	3584900	4.82
Spain	**3544055**	**3.57**	**3070116**	**3.29**	**2401140**	**2.88**	**1917770**	**2.58**
Vietnam	2553000	2.57	1653595	1.77	1154200	1.38	820000	1.10
Brazil	2479951	2.49	2798000	3.06	2350000	2.81	2300000	3.09
France	2281000	2.29	2346000	2.52	2219000	2.66	1903000	2.56
Poland	2150700	2.16	2023300	2.17	1891300	2.27	2035600	2.74
Canada	1894380	1.91	1858352	1.99	1256700	1.51	1207700	1.63
Denmark	1802195	1.81	1759000	1.89	1520600	1.82	1369700	1.84
World	99211931	100	93066251	100	83346376	100	74251472	100

Source: FAO, 2008

With regard to the production regions, the Chinese pig production are concentrated in east China, which could be divided into northeast China, Northern China, Southeastern China and the Yangzi River Region (see table 6 and figure 9).

[1] Annual Alimarket 2007

Table 6. Regional distribution of pig production in 2007 in China

Region	Provinces	% share of the national pig production
The Yangzi River Region	Sichuan, Chongqing, Guizhou, Hunan, Jiangxi, Zhejiang, Jiangsu and Anhui	39.7
Northern China	Hebei, Shandong and Henan	19.8
Southeastern China	Fujian, Guangdong, Yunnan and Hainan	14.4
Northeast China	Liaoning, Jilin and Heilongjiang	8.4

Source: China Statistical Yearbook, 2008

Figure 9. Main pig production areas in China

Source: drawn by the author

There are three main types of pig production in China: **unspecialized households, specialized households and commercial farms.** The unspecialized households refer to the backyard family household pig raising way with less than 10 heads of pigs produced per year. The specialized households refer to farmers specialized in producing pigs with a larger scale of 10-500 heads of pigs produced per year. The commercial farms refer to big pig producing companies with a production scale of more than 500 heads per year. The proportion of the hog supply from these three sources is as follows: about 80% of China's pork output comes from small individual unspecialized backyard farms, whereas 15% from specialized households and merely 5% from large commercial farms (USDA FAS Gain Report, 2006). Table 7 shows the size of farms and number of slaughtered pigs for 2003. The numbers of commercial farms are increasing in China in recent years, but family household pig production still dominates the production.

Table 7. National swine size of farm and slaughtered pig in 2003

Number of heads kept on farm	number of farms	percentage（%）
1 – 9	101,963,901	94.483
10 – 49	4,815,474	4.462
50 – 99	851,429	0.789
100 – 499	249,016	0.789
500 – 2999	33,844	0.031
3000 – 9999	3,388	0.003139
10000 – 49999	911	0.000844
50000 and above	30	0.000028
Total	107,917,991	100

Source: USDA FAS GAIN Report Livestock and Products Semi-Annual, 2005

Although the unspecialized household farms dominate the production of pigs in China, the specialized farms and commercial farms are gaining importance in the pig production industry due to the encouragement of the Chinese government and consumers' demand for lean pork. The commercial farms are developing fast year by year.

-Spain

Spain is the second biggest pork producer in European countries with an annual production value of 4,000 million Euros (MARM, 2009). Pork sector is in the first place of Spanish livestock sector. The main production areas are *Andalucia, Aragon, Castilla y León, Cataluña and Región de Murcia*, all of which produce more than 2000 thousands of heads of pigs every year (see table 8).

Table 8. Distribution of pig productions by autonomous communities in Spain (thousands of heads in December of every year)

Region	2000	2001	2002	2003	2004	2005
ANDALUCIA	2.368	2.249	2.223	2.373	2.533	2.221
ARAGON	3.526	4.134	3.83	3.799	4.529	4.509
BALEARES	39	48	53	51	44	41
VALENCIANA	1.12	1.128	1.129	1.3	1.174	1.227
CANARIAS	63	74	75	66	70	63
CANTABRIA	23	23	14	14	17	17
CASTILLA LA MANCHA	1.293	1.912	2.052	2	1.679	1.558
CASTILLA Y LEON	3.1	3.36	3.305	3.338	3.578	3.577
CASTILLA-LA MANCHA	1.293	1.912	2.052	2	1.679	1.558
CATALUÑA	5.885	6.108	5.897	6.204	5.971	6.314
COMUNIDAD F. NAVARRA	470	555	571	535	575	558
COMUNIDAD VALENCIANA	1.12	1.128	1.129	1.3	1.174	1.227
EXTREMADURA	1.343	1.476	1.298	1.278	1.67	1.682
GALICIA	988	777	750	878	821	848
ILLES BALEARS	39	48	53	51	44	41
LA RIOJA	118	117	116	103	90	106
MADRID	44	47	35	16	45	45
NAVARRA	470	555	571	535	575	558
Other sacrifices	0	0	0	0	0	0
P. DE ASTURIAS	35	35	37	39	31	30
PAIS VASCO	46	41	38	36	35	32
PRINCIPADO DE ASTURIAS	35	35	37	39	31	30
R. DE MURCIA	1.688	1.774	2.095	2.023	2.033	2.056
REGIÓN DE MURCIA	1.688	1.774	2.095	2.023	2.033	2.056
Spain	26.794	29.31	29.455	30.001	30.431	30.354

Source: MARM, 2009

The production of pigs in Spain has its uniqueness because of its special natural areas in raising Iberian pigs extensively. The Spanish "*jamón iberico*" (Iberian ham) is a special pork product, the breed, feeding, pig production, slaughtering and processing are different from the white pig pork production. The product is divided into different series according to the genetics, feed and elaboration process. There are differentiated with 100% pure Iberian breed or mixture with Duroc-Jersey, fed with *Bellota* (acorn), *Recebo* (mixture acorn and fodder) and *Cebo* (fodder), maturing

period, acid fats and organoleptic characteristics. The extensive-raised pigs live in the "*Dehesa*", locating in *Extremandura*, which is a forest cleared by human hands where main trees are holm oaks and cork oaks playing a fundamental role of general stabilization, providing acorns, browse, fuel wood, cork, edible fungus, pollen and some more resources. There are also intensive farms mainly in *Agragón, Cataluña, Catillna La Mancha* and *Comunidad Valenciana*, and mixed farms in *Castilla y León* and *Andalucía* (see figure 10).

Figure 10. Pig production area in Spain

Source: MARM, 2009

The scale of the farms in Spain is shown in table 9.

Table 9. Number of farms of pigs depending on its productive

Farms	Number of farms
Selecting farms and other special farms	10.156
Until 120 UGM	24.311
From 120 to 360 UGM	7.476
From 360 to 864 UGM	1.425
Productive capacity smaller than 4,80 UGM	32.710
Unknown	23.483
Total	99.561

UGM: livestock unit
Source: Registro General Explotaciones Ganaderas (REGA) updated April 2007

3.2.4 Pig slaughtering and processing

-China

The pig slaughtering and processing in China is a coexistence of fragmentation and integration.

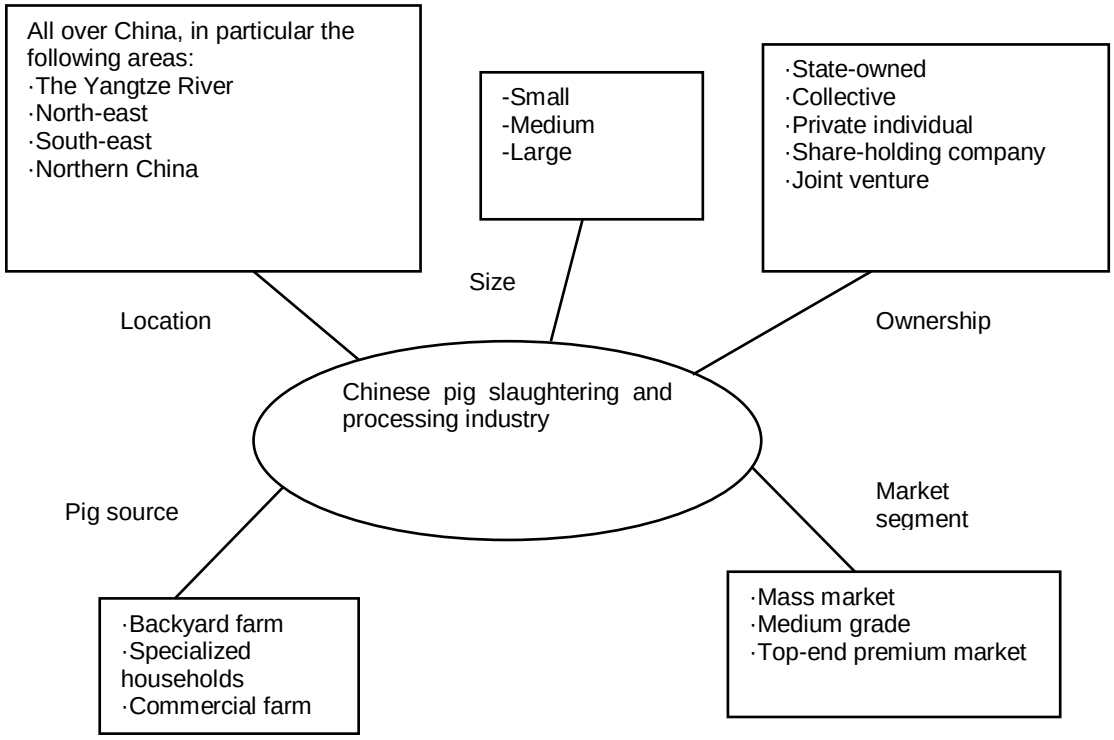
Before 1985, the slaughtering sector was under the state monopoly. Slaughtering operations and distribution outlets were organized by the General Food Companies (GFC) set up under the previous Ministry of Commerce (renamed Ministry of Commerce in March 2003).

On January 1st, 1998, the "Designated Hog Slaughtering Act" was issued by the government, during 1985 to 1995, many designated slaughterhouses were established. There were around 40,000 designated slaughterhouses all over the country in 2003, many of which are small-scale and moderately equipped at best (Pan, 2003).

At the same time, private butchers gained rapid development due to convenience provided to the backyard farms and low cost operation. The liberalization has helped promote hog production sector. However, illegal slaughtering caused potential quality and safety problems, while at the same time the slaughtering capacity of designated slaughterhouse are not fully utilized (Chen, 2003). This is what we call fragmentation of the slaughtering.

On the other hand, big pork processing companies integrate with slaughterhouses. For example, *Yurun* group is one of the biggest pork companies in China. It has its own slaughterhouse and processing lines, and it slaughters 18 million heads of pigs per year. Here we describe the pig slaughtering and processing industries according to their location, size, ownership, pigs source and market segment (see figure 11).

Figure 11. Chinese pig slaughtering and processing industry



Source: drawn by the author

Size:

Slaughtering and processing companies can be divided into three categories at a broad level: small-scale, medium-size and large scale companies.

In general, the designated pork slaughterhouses at village level are rather small scale, slaughtering only several dozen of hogs per day. When there are important festivals, they slaughter more than usual.

The medium-sized slaughterhouses kill around a million hogs per year. The largest processor slaughters 13.1 million hogs every year. However, the slaughtering industry does not have a high concentration ratio. The hogs slaughtered by three leading meat processors accounted for only 4% of the industry in 2006. The majority of the hogs slaughtered in the industry are from small scaled butchers. On the other hand, the Chinese meat slaughtering and processing industry is experiencing a consolidation and restructuring period. Prof. *Zhou Guanghong*, chairman of the Chinese Association of Animal Products Processing, expected that large and medium sized meat processors will have 70% of the market share by 2020, supplying their products mainly to large supermarkets.

Large scale companies operate better cold storage facilities. They are called "dragon-head" companies in China, which means leading companies in the sector. They are involved in the activities of integrating themselves with small-scaled farmers, driving the integration of the chain. The top 3 pork slaughterhouses and processors and their turnover are listed in Table 10.

Table 10. Top 3 pork slaughtering and processing companies in China in 2008

Name	Turnover (Million Euros)
Henan Shuanghui Group	2600.9
China Yurun Group	1146.1
People's Food Group	1081.1

Source: 2008 annual report of the three companies

Ownership:

The ownership of the slaughtering and processing industries in China is diverse and complex due to the economic reform in China.

Economic reform and market imperatives have placed great pressure on state-owned slaughterhouses to restructure. The different scope, timing and nature of this restructuring process have resulted in a variety of ownership structures and management practices (Longworth et al., 2001). For example, many of the previously stated owned companies are now run by private shareholders. Medium scaled state-owned slaughterhouses have also been under great pressure to restructure and to seek external funding and acquire the necessary management skills to survive. Even the large, modern agro-industrial abattoirs have a range of ownership structure. Once very popular, the state-owned "Meat Alliance Plants" were reformed to private ownership in large numbers. Though they sell some of their products through wet markets, they mostly cater for supermarkets, hotels, restaurants, and other institutional buyers (Fabiosa et al., 2005).

With regard to foreign investment, some international players have already started to run business in China. But as so far, the 100% foreign-owned companies in the sector are very few due to uncertain profit margins. Joint ventures do exist; the American Hormel Foods Corp. operates two joint ventures in Shanghai and Beijing. The ownership of the meat processors in 2006 is shown in Table 11.

Table 11. Main economic indicators of the meat products companies (100 million €)

	No. of companies	Total asset	Sales turnover	Total profit and tax	Total profit	No. of Employees (10,000)
Total	1048	621	1019.5	66.2	45.9	26.9
State-owned	52	19.3	16.1	0.7	0.4	1.1
Collective	34	5.0	13.4	0.8	0.5	0.3
Share-holding	619	284.6	519.6	37.6	24.7	13.3
Joint venture	171	285.9	407.0	22.6	17.2	10.4
Other type	172	26.2	63.4	4.5	3.1	1.8

Source: Statistics and Information Department, China Association of Food Industry, Dec. 2006

From table 11, we can see that the share-holding companies play a very important role in the meat processing sector. There were 619 companies with a total asset of nearly € 2.9 billion, accounting for 45% of the sector. The sales volume of these share-holding companies stood at 50% of the sector. With a total asset of nearly € 2.9 billion, the joint venture companies had a sales volume of € 4 billion, contributing to 40% to the sector. Thus, the share-holding companies and the joint ventures are the key players in the meat slaughtering and processing industry. Their total asset, sales volume, and profit and tax all accounted for more than 90% of the whole sector.

-Spain:

Spain slaughtered 38,733,000 heads of pigs in 2006, which accounted for 16% of that in European Union (MRAM, 2009). There were 589 livestock slaughterhouses in 2004, and the top 10 make 25% of the slaughter[1].

The slaughterhouse can be either specialized in a species like pigs, or work with all kinds of species like cattle and sheep. Also, they can be either specialized in slaughtering or integrated with processing industries. Some of the slaughterhouses are family companies with a long history, they were just abattoir when they were founded and later grow into bigger companies with more businesses included. MONTARAZ (*Jamones y Embutidos, S.A.*) is a company that was created 120 years ago, which is specialized in slaughtering and deboning of livestock. These companies usually emphasize in quality management and aim to provide consumers products with good quality, in their development process, they are also equipped with modern slaughtering technical lines and try to meet national and international quality standard. Some of the slaughterhouses are newly established in the 1970s or 1980s; they are equipped with advanced slaughtering and deboning conditions, putting great importance in quality management in all process of their slaughtering and cutting. It is

[1] Agencia Española de Seguridad Alimentaria

obligatory that the slaughterhouse in Spain implement HACCP quality standard[1]. These slaughterhouses pay attention to environmental management as the slaughtering always creates contamination. *Friselva, S.A.*, a slaughterhouse and cutting room was founded in 1975, was the first slaughterhouse in Spain to implement a system of environmental management, based in the ISO 14001 standards. With this system, *Friselva* undergoes a strict classification of waste. At the same time, these newly established companies start to spread their business to international market due to the globalization of the world market.

On the other hand, there are big processing companies that are integrated with slaughterhouse. There are 4,800 processing industries in Spain in 2004, and the biggest companies such as *Campofrio, ElPozo* and *Casa Tarradellas* produce 168,500, 82,000 and 63,000 millions of tons of pork respectively in 2006.

Big companies are highly concentrated, the first two account for 40% of the production, and the biggest one accounts for 30% of the production (Peña, 2009), which is quite different from the situation in China. These companies have long histories of development. *Elpozo* integrated slaughterhouse and processing industries, during its more than 70 years' development, its equipment, quality control system and logistic system are dramatically advanced, and its financial capacity have grown greatly. It's common that these big companies are lively involved in asset market; *Campofrio* is a listed company in stock market in 1988. It actively takes part in merge and buy-out business in order to get scale advantage, *Campofrio* was acquired 21% by Hormel in 1997, and it bought *Montagne Noire* (France), *Fricarnes* (Portugal), *Morliny* (Poland) y *Tabco* (Rumania) in 1998 and 1999, later it was acquired 22.4% of Smith Field Foods, Inc. in 2004[2].

There are also totally independent processors which only specialize in processing pork done by slaughterhouse, the slaughterhouse and processing industries are spread geographically according to the pig production areas in Spain. Usually the processing industries are close to the slaughterhouse and production farm considering reducing the cost of transport. The principle processing industries in Spain are listed as the following table 12:

[1] Royal Decree 2207/95, in which regulations regarding hygiene of food products are established (transposition of the Common Directive 93/43/CEE). It points out the mandatory of implementation of adequate safety procedures referring to the HACCP (Hazard Analysis and Control of Critical Points) procedure.

[2] http://www.campofrio.es/

Table 12. Principle processing industries in Spain

	Enterprise	Location	2005	2006	Brand
1	Campofrío Alimentación S.A. (Grupo)	Burgos (BU)	140,000	168,500	Campofrío/OscarMayer /Navidul/Revilla
2	Elpozo Alimentación S.A.	Alhama de M. (MU)	78.000	82.000	Elpozo/ Almirez
3	Casa Tarradellas, S.A.	Gurb-Vic (B)	56.000	63.000	Casa Tarradellas
4	Grupo Alimentario Argall, S.A.	Miralcamp (L)	34.230	36.142	Argal
5	Embutidos y jamones Noel, S.A.	S. Joan les Fonts (GI)	24.000	25.000	Noel /Curós
6	Ind. Carnicas Loriente Piqueras, S.A.	Tarancón (CU)	12.086	21.059	Incarlopsa/Sierramón /Hacendado
7	Embutidos Monells, S.A.	Seva (B)	20.081	20.946	Monells
8	Corp. Alimentaria Guissona, S.A.	Guissona (L)	18.300	19.000	CAG de Guissona
9	Casademont, S.A. (Grupo)	Bonmatí (GI)	20.000	18.000	Casademont
10	Industrias Cárnicas Tello, S.A	Totanés (TO)	16.200	16.045	Tello

Source: Alimarket, 2008

3.2.5 Pork distribution and marketing

-China

As China has undergone several economic transformations since the foundation of R.P. of China, a brief introduction of the development of the Chinese pig/pork distribution and marketing is made beforehand.

The first period (from 1949 to 1954):

To recover the national economy and meet the societal needs after the foundation of People's Republic of China in October 1949, the central government encouraged private operation of pork and poultry business. During this period, both state owned and private business entities were involved in pork distribution and marketing chain on the basis of free market competition, with 46.01% of pork supply from the state owned companies.

The second period (from 1955 to 1984):

The State planning system for both hog slaughtering and pork marketing was applied during this period. The dominant position of the state owned companies on slaughtering of pork for consumption in urban areas were set up. The hog procurement quota was applied in the main hog production areas. Farmers had to sell the quota to the state at fixed prices. Only over-quota pork was supposed to be sold freely in the market. At times when there was plenty of hog supply, free pork supply was implemented at fixed prices.

The state controlled planning system played important role at that particular time. However there were several shortcomings. The main one was that the state monopoly not only resulted in rigid marketing channels, but also hindered competition. The pork prices set up by the state were not able to reflect market demand. Therefore, it was imperative to reform the system.

The third period (Since 1985):

In 1985, the national government issued "Ten policies on further vitalizing rural economy". The Chinese government started to liberalize pork production and marketing.

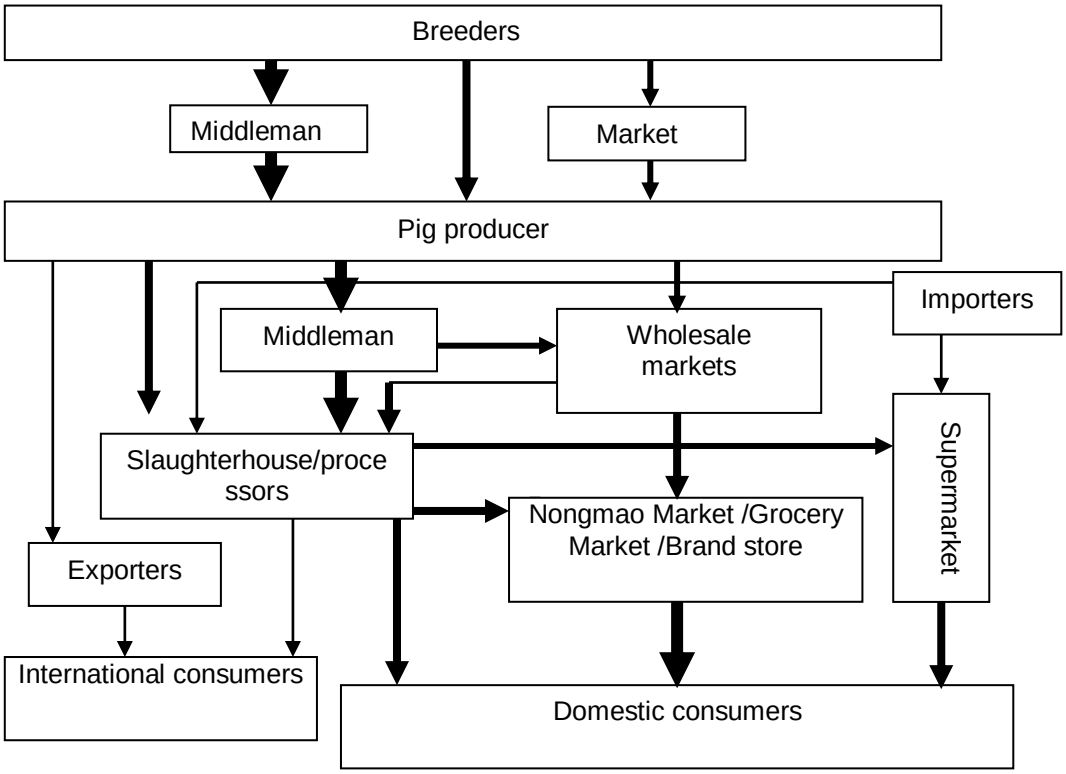
With the elimination of the quota production system, pork production and marketing started to perform on market mechanism. The policies included free access to market, free transaction, market-driven and quality-oriented price setting.

Thus, 1985 represents a watershed in the development of a modern pork distribution system in China (Longworth et al., 2001). The state monopoly was broken featuring that large number of pork wholesale and retail markets were set up during this period. Marketing channels were therefore greatly diversified. Farmers were allowed to sell their products to urban areas directly. The reforms provided farmers with great incentives and made the market live.

The early stage of free market operation posed challenges to the functioning of the market mechanism. The immature market mechanism made it possible for the opportunistic brokers to make money by doing illegal business.

With regard to the distributors in pork chain in China now, the distribution channels of pig/pork vary a lot, it is described in the following figure 12.

Figure 12. Distributions channels of pig/pork in Chinese pork chain



Source: drawn by the author

Figure 12 is explained in detail in the following part:

Breeder-Producer:

The distribution of piglets from breeders to producers can be direct business, middleman or market. In rural area, the household pig breeders can choose to sell their piglets to pig producers they are familiar with directly, or they can choose to sell the piglets in livestock trading market. Big piglet breeders sell directly the piglets to producers through one-shot deal or long-term contracts.

We call the middleman "*fàn zi*" in Chinese, meaning that they gain profits through doing the business in buying piglets from household breeders and then selling piglets to pig farmers (household pig farmers or commercial pig farmers).

The existence of "*fàn zi*" has its reasons. Firstly, as the household breeders are of great amount with small scales, scattering in the countryside, information between breeders and pig farmers is asymmetry. Secondly, the scales of the commercial farms are increasing, the supply of piglets are always not able to meet the expansion, they need a lot of piglets with the preference to deal with the "*fàn zi*" instead of dealing with

the household breeders in order to reduce the transaction costs such as searching and providing transportation. Therefore, middlemen ("*fàn zi*") do their business actively between these two links of the pork chain and gain their profits from the price difference.

Producer-slaughter/processor:

The distribution channels between pig producer and slaughter/processor (as many big pig processors are integrated with slaughter) are quite similar with that between breeder and producer. Big pig producers (like commercial farms) usually sell the pigs to slaughter/processor directly or through livestock market. As to the household pig farmers, the middlemen again play important role.

Take *Luohe* city in Henan province as an example. Henan province is a province where concentrates 25 big pork processing companies. It's also the production base of *Shuanghui* Group, the biggest pork processing company in China. Many rural families in *Luohe* city raise pigs with small scale, when the pigs are finished, they want to sell them to the big pork processing companies, and there are problems such as: first, they don't have information about the market; second, they don't have private transportation such as trucks or cars, third, the big processing companies would not like to apply private transportation to go to the rural area to purchase pigs family by family in order to reduce the cost.

As a result, *"fàn zi"* here take the opportunity, owning or hiring the trucks, going inside rural areas to purchase pigs, making profits from purchasing the pigs and then selling to companies. However, this way of distributing pigs exerts potential safety and quality problems of pork, the middlemen usually don't take care of transporting the live pigs, in some cases, the pigs get sick or other problems during their way to big companies.

Slaughter-processor:

Fresh pork comes from slaughtered pigs goes to fresh pork market or go to processing industries. Independent slaughter will distribute their pork to processors directly.

Slaughter-consumer:

Fresh pork is distributed to consumers through (1), slaughter-wholesaler-retailer-consumer or (2), slaughter-retailer-consumer. Now in china, big cities such as Shanghai, Guangdong and Beijing have big pork wholesale

market due to great pork consumption. Some slaughters choose to distribute pork directly through retailers such as supermarkets, brand store or *"Nóng mào"* market, which will be explained in the following paragraph.

Processor-consumer:

Processed pork products also are distributed through (1), slaughter-wholesaler-retailer-consumer or (2), slaughter-retailer-consumer. The retailers are supermarkets, brand stores and *"Nóng mào"* markets. These three main types of retailers in China also have their different target market, which are *"Nóng mào"* market, supermarkets/hypermarkets and brand stores.

"Nóng mào" market:

"Nóng mào" market is a type of wet market in China; it is the most popular and preferred avenue outlets for consumers to purchase fresh meat in most of the cities and rural areas. In rural areas, they are usually sold open air, we call the pork "hot fresh pork", which means fresh pork from pigs freshly slaughtered without cooling procedures. *"Nóng mào"* market is usually crowded without good hygiene conditions and their target market is their neighborhood rural or suburban residents.

The *"Nóng mào"* markets in urban areas are usually both indoor and outdoor wet market. They are more developed with better hygiene conditions. It's a place combined with sales of fresh food, such as vegetables, meat or cereals, etc. It's a traditional and common place for urban residents to purchase pork, before the existence of modern supermarkets and hypermarkets, almost all the pork and its products were distributed to consumers there.

With a population of about 6 million people in Nanjing, a medium sized city in China, there was nearly 300 *"Nóng mào"* market in 2005. They vary from very large markets with hundreds of separate stalls located in specially constructed, sometimes multi-storied buildings, to open air markets with a large number of stalls, to small, simple markets consisting of a few stalls. They are open all day. Most stall operators are full-time traders; and these operations are licensed and inspected by the local branch of the Industry and Commerce Administration (ICAB) (Longworth et al., 2001).

In *"Nóng mào"* markets, most stallholders sell fresh pork products. However, there are also some stallholders selling cooked and other processed pork products, such as sausages and ham. In some of the more sophisticated and highly developed *"Nóng*

mào" markets in cities, several of the major Chinese meat companies have installed shops installed with freezing facilities and display products in glass cabinets. This may be is in sharp contrast to the open-air display of pork on wooden tables in other stalls in the same *"Nóng mào"* markets in rural areas.

-***Supermarkets/hypermarkets*:**

Nowadays, in accordance with the higher demand in food safety and quality of consumers, supermarkets and brand stores are developing fast and gaining more and more importance.

More than a decade ago, supermarkets emerged in Chinese cities. They have become a major force in food retailing in many cities in China since the late 1990s. Studies have shown that supermarkets, hypermarkets and brand stores are spreading rapidly in the top 60 cities of China. Besides the major coastal cities, supermarkets are now gaining increasing foothold in the top, second and third tier cities all over China (Reardon et al., 2003).

Fresh products section was very limited in the late 1990s in the supermarkets in China. Since the late 1990s, the existence of vacuum-packed products drove the existence of fresh products. Generally speaking, the quality of the products in the supermarkets and the way they are presented to the consumers are significantly better than in most of the stalls in the *"Nóng mào"* markets. Therefore, the prices also tend to be higher.

Although supermarkets develop rapidly in China, many of them have been handicapped by a poorly managed fresh products sections. Though packaged food might be successful, fresh meat has not been an important proportion of sales for many supermarkets (Pan and Kinsey, 2002). Compared with domestic supermarket chains, the foreign-invested hypermarkets have a better managed cold chain for meat products such as Carrefour, Makro, Metro and Wal-Mart.

These hypermarkets, together with the large Chinese supermarket chains, usually have a limited number of suppliers of meat products. These carefully selected suppliers are mostly integrated commercial-type producers that can assure both product quality and consistency in supply (Fabiosa et al., 2005). Experts predict that the market share of meat sales through supermarkets will increase from 15% at present to 40% in the future decade (Zhou, 2006).

Brand stores:

Chapter 3

Brand stores are new ways of distributing pork in China. It is established by great slaughters or processors companies using their own brands. The brand stores operate the business with cold fresh pork and its products, adopting the “producing, transporting, selling in cold chain and operating in the form of chain stores” model. Brand stores are divided into direct chain stores and franchise chain stores; direct stores are directly run by pork companies and franchise chain stores are run by regional agents.

In 1999, *Shuanghui* Group firstly tried the way of brand stores to distribute its pork, it implemented “unified image, unified standard, unified service, unified delivery and unified management” as its development mode, actively promoting sales of cold fresh pork in brand stores. *Shuanghui* was the pioneer of brand stores’ development, later *Yurun*, *Jinluo* and *Zhongpin* continually started their brand stores.

During 2003 to 2008, *Shuanghui*, *Yurun* and *Jinluo* have had 10000, 8000 and 5000 pork brand stores respectively across China. Seeing the success of brands stores in China, other medium sized companies also started to distribute their pork through brand stores, now the numbers of brand stores in big cities of China, such as Beijing, Shanghai and Nanjing, are reaching their saturation.

The advantages of brand stores are obvious. On one hand, the brand stores provide fresh or cured pork products with good quality directly branding the name of the companies; at the same time, as fresh pork is perishable and it is widely and frequently consumed in China, consumers are able to buy fresh pork with ease and convenience whenever they want from brand stores as they are intensively located in residence zones with quality and price affordable. On the other hand, the companies who own the brand stores have great control power on those chain stores, and they gain more profits than distributing their products through supermarkets and hypermarkets.

Figure 13. Nóng mào Market, Supermarket and Brand store

Nóng mào Market

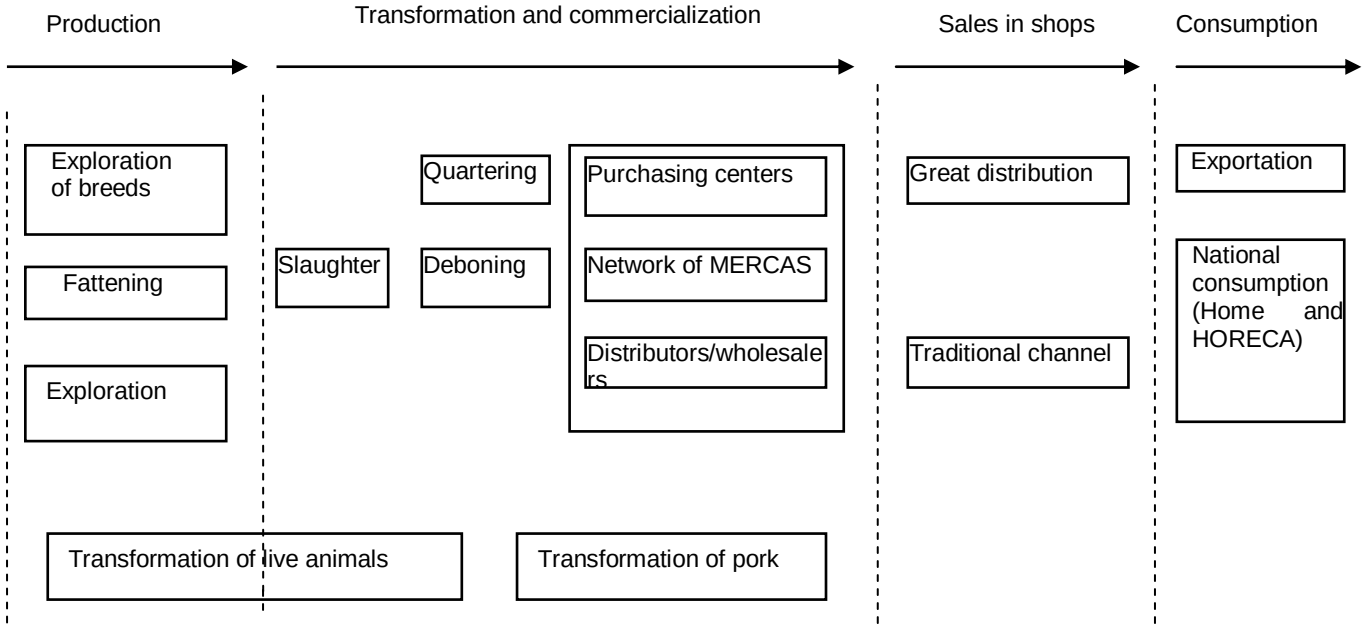
Supermarket

Brand store

-Spain

The distribution channels of agricultural products in Spain are shown figure 14. After pig production, the pigs are distributed through operators in origin, which means the operators that are close to original production in the chain. After slaughtering and deboning, the pork is distributed through purchasing centers, second grade cooperatives, network of MERCAS, distributors and wholesalers.

Figure 14. Distribution chain of pig/pork in Spain



Source: MARM, 2009
HORECA is the abbreviation of Hotel, Restaurant and Cafeteria

Purchasing centers:

Purchasing center is a business formula that groups the purchasing power of its members, it represents great volumes of purchase and it has great power to negotiate with the supplier. The members retain their ownership and independence on their own

business. Purchasing center provides services related to technology, finance, information and advertising, etc. to their members that the members are not be able to achieve individually.

Actually, the purchasing center is a purchasing alliance which achieves great bargaining power with their supplier. In Spain, there are 67 purchasing centers in agricultural sector, and there's a trend of concentration. The main purchasing centers in Spain are shown in the following table 13.

EUROMADI Group runs its business in different sectors, such as meat, vegetable and fruits, perfume, HORECAs, etc.

Meat sector is operated through the subsidiary company *Markant Servicios Cánicos EMD*, founded in 1995 and located its headquarters in Barcelona. Its basic objective is to offer its associates fresh meat of the highest quality identified with the label ¨EMD Quality Guarantee¨.

Table 13. Main purchasing centers existing in Spain and their market share respectively

Purchasing centers	Market share		
	1996	2003	2005
IFA	22.1%	20.9%	20.4%
EUROMADI	22.2%	17.8	17.8%
CARREFOUR Group	n/a	18%	17.7%
EROSKI Group	n/a	12.8%	10.1%
The rest	n/a	30.5%	34%
Total	n/a	100%	100%

Source: SDV Consultores MARM and ACES, 2008

Network of MERCAS:

The MERCAS are huge wholesalers of agricultural products. They distribute agricultural products to their downstream partners with great volume of sales, which include meat, vegetables and fruits, seafood, flowers so on and so forth. The network of MERCAS is spread around urban areas across Spain with a 7 million square meters (see figure 15), 20% of the consumption of meat are distributed through the network of MERCAS.

Figure 15. Networks of MERCAS in Spain

Source: SDV *consultores* MARM and ACES, 2008

MERCAMADRID was founded in 1982, which is the central food market in capital of Spain. It is run by *MERCAMADRID, S.A.*, its business stretches in fish, fruit and vegetables, and meat, as well as diverse companies specialized in the different sectors of the food industry. It is consisted with fish market, fruit and vegetable market, meat market, commercial and administrative service area, services and warehousing (SW), parking areas and roadways, landscaped areas, internal uses, C.T.M. (Madrid Transport Center) with a total surface area of 1,761.568 square meters, in which meat market takes 32,600 square meters. Meat market responds to the challenge of efficiently and reliably serving the most important food sector in Spain. All the units are well-equipped with conditions of hygiene and safety; fresh, chilled and frozen meat and cured meat are well kept under safety and quality control of *MERCAMADRID*.

Now the meat market is concerned not only with distribution but also with production. Many farmers participate directly in the market as it actively promotes products with denomination of origin and quality certificates. The meat market distributes great volumes of pork every year and the volume increases fast year by year (See table 14). From table 14 we can see that fresh meat product is the main business of meat market of *MERCAMADRID*.

Traditional shops:

Traditional shops are main distributors of agricultural products in Spain. They are specialized shops in different agricultural products, such as "*frutería*", shops for fruits; "*pescadería*" shops for fish products; and in meat sector, it is called "*carnicería*", which means meat shop. These shops are usually family-owned with long history. They specialized in selling meat with the service from sales assistant, they provide different fresh or cured meat products with cooling conditions, which means the quality and safety of meat and the products could be guaranteed.

Their main advantage is that they are located intensively and close to the residence place, where the consumers purchase with convenience. Clients and shop owners usually know each other well and trust each other like neighbors. Consumption is small amount with high frequency, Shop assistants give their clients suitable suggestions in their purchase and this group of consumers is stable. Now the traditional stores channeled more than 37% of sales (Langreo, 2006), five points less than in 1996, but it still remains strong in comparison with other agricultural subsectors.

Table 14. Pork distributed by MERCAMADRID Unit: kg

	2004	2005	2006	2007	2008	2009
Various fresh	36.740	253.328	570.086	227.317	5.986.591	10.036.279
various freezing	34.260	890.494	114.674	13.178	1.476.677	3.030.474
Fresh bovine meat	43.037.11	51.872.252	44.962.295	45.471.811	57.295.973	59.228.150
Frozen bovine meat	429.155	707.262	857.640	4.921.379	12.055.435	11.980.387
Fresh pork	**15.538.64**	**19.211.549**	**23.798.55**	**39.232.59**	**55.771.13**	**59.797.209**
Frozen pork	**142.629**	**307.702**	**153.595**	**5.262.749**	**4.873.033**	**4.305.102**
Fresh poultry meat	370.270	1.407.029	1.045.531	4.738.903	18.615.539	21.559.078
Frozen poultry meat	16.943	344.916	441.494	1.462.002	2.884.223	2.695.190

Source: www.mercamadrid.es

Traditional shops

Supermarket

Hypermarket

Great distribution:

Great distribution refers to distribution channeled by supermarkets and hypermarkets. Its appearance made it a success as it provides all kinds of products in the same place, which saves time as the modern life rhythm is quite fast. Big supermarkets and hypermarkets are usually far away from the city integrated with various kinds of shops, cafeterias, places of recreations, etc., which forms a commercial center. Supermarkets and hypermarkets are accounting more and more percentage of the distribution of agricultural products. But hypermarkets penetrate in meat products slowly as they focus in long-lasting products selling.

Wet market:

Wet market exists in Spain. It locates in residence places with collections of different shop-owners. Distributions there are small amount with high frequency and large group of consumers, price there is normally lower than that of supermarkets. The meat distributors there have good cooling and frozen conditions to maintain the meat safety. But the numbers of this kind of wet market are not many as traditional meat markets and supermarkets and hypermarkets.

Private-owned chain store:

Through the investigation, the author finds that there are also private-owned chain stores in Spain, which is similar to the brand store in China. "*Grupo Alimentaria Guissona*", one of the biggest meat company, has more than 365 own chain stores named "*bonÁrea*" in *Cataluña, Aragón, Castellón, Andorra, Guadalajara* and Madrid city. It offers all the products produced by its own group. But this form of distributing meat products is not common in Spain, and the scale of ¨*bonÁrea*¨ is much bigger than that of *Yurun* and *Shuanghui* in China.

From the survey we get to know that the meat distributors in *Mercamadrid,* great distribution and traditional shops bought their products from deboning rooms, and

later they distribute to different target market. For example, meat distributors mainly sell their products to hotel, restaurant, schools etc., while great distribution, traditional stores sell the products to personal consumers.

3.2.6 Pork Consumption

China

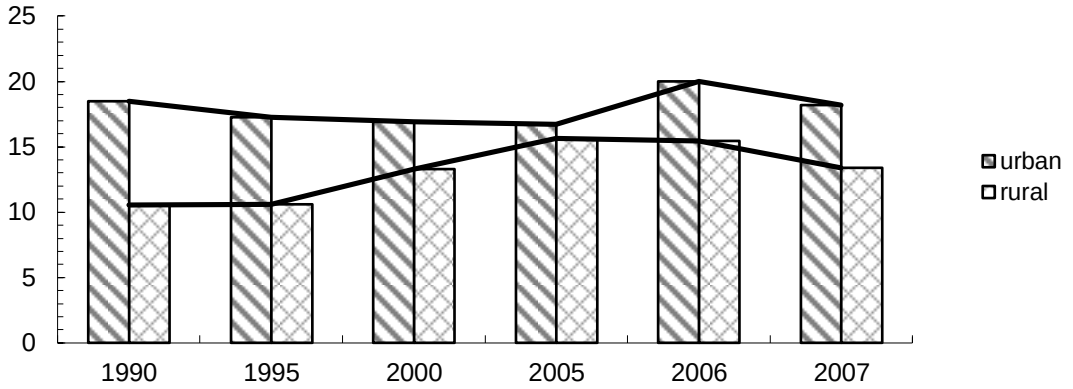
Due to the impact of broad macro-influences such as rising incomes, increasing urbanization of the population, greater availability of ruminant meat (beef, goat meat and mutton) and rapid development of poultry industry in the last decade, the share of pork consumption among all meat has decreased substantially. However, pork still remains the most popular meat consumed in China.

With regard to the consumption per capita, it is worth to mention the data given by National Bureau of Statistics of China (NBSC) and the data given by academic scholars are different. The data given by NBSC is always less than the data given by academic scholars, it is generally recognized the data of NBSC doesn't take account into the meat consumption in restaurants and institutional consumptions. If we take account into the consumption of pork outside home, the pork consumption per capita will be the more or less double the quantity given by NBSC.

To avoid confusion, the data of consumption per capita of pork used in this work will be all from NBSC. According to the data of NBSC, pork dominates the consumption ratio from 60% to 80% of meat consumption in urban and rural residents. The pork consumption per capita in urban areas is more than that of rural areas though the consumption is generally declining, while the trend of pork consumption in rural areas is generally increasing. Beef, mutton and poultry consumption in urban and rural areas are both increasing (see figure 16, 17 and 18).

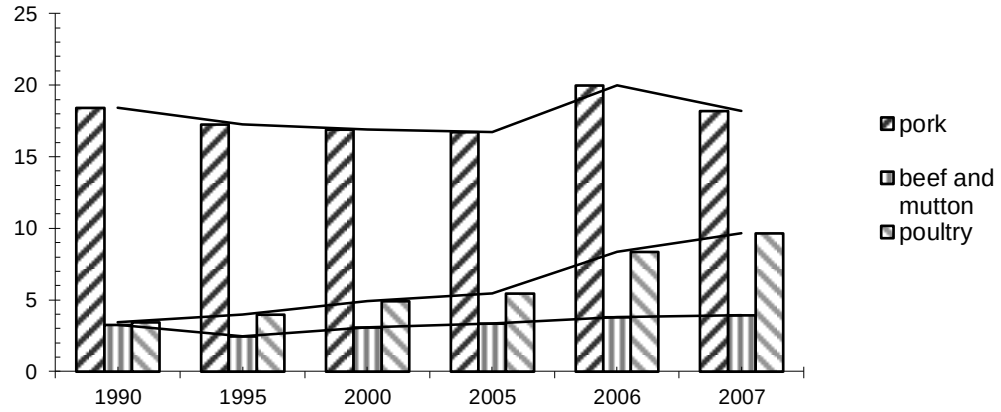
The following part will emphasize three points: the key pork consumption areas in China, the main characteristics of pork consumption and future consumption.

Figure 16. Pork consumption per capita in urban and rural areas



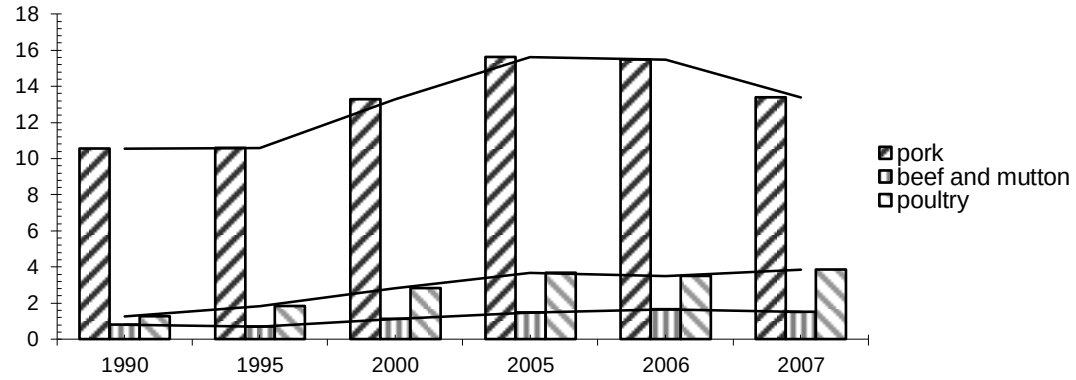
Source: National Bureau of Statistics of China 2008

Figure 17. Pork, poultry, beef and mutton consumption per capita in urban area in China



Source: National Bureau of Statistics of China 2008

Figure 18. Pork, poultry, beef and mutton consumption per capita in rural area in China



Source: National Bureau of Statistics of China, 2008

- Key pork consumption areas

The amount of pork consumption varies due to the impact of habit, production structure and religion. In north-eastern areas of China, the proportion of beef, mutton and goat meat is bigger than the other areas while pork products are not in a favorable position. The main pork consumption area is in the south of the *Yangzi*

River area (traditionally this has been the main pork consumption region) and the south-east coast area (the economically developed area). *Guizhou* province consumes the highest amount of pork in China. Figure 19 shows the two main pork consumption areas and one of the areas with least pork consumption in China. Table 15 and table 16 show the areas where pork is the least and the most consumed meat product respectively in China.

Structure of pork products consumed

70% of pork consumed in China is fresh pork, which includes hot fresh pork, chilled and frozen pork, 30% of pork goes to the processing areas (Chen, 2003). Processed pork products mainly include: bacon, barbecue, fried meat, sausages, salami, ham, Western-style products, which accounted for more than 40%. Sausage production reached 80 million tons of pork processed products accounted for 30% of total processed pork products (Wang, 2007).

Figure 19. Provinces with lowest and highest consumption of pork in China

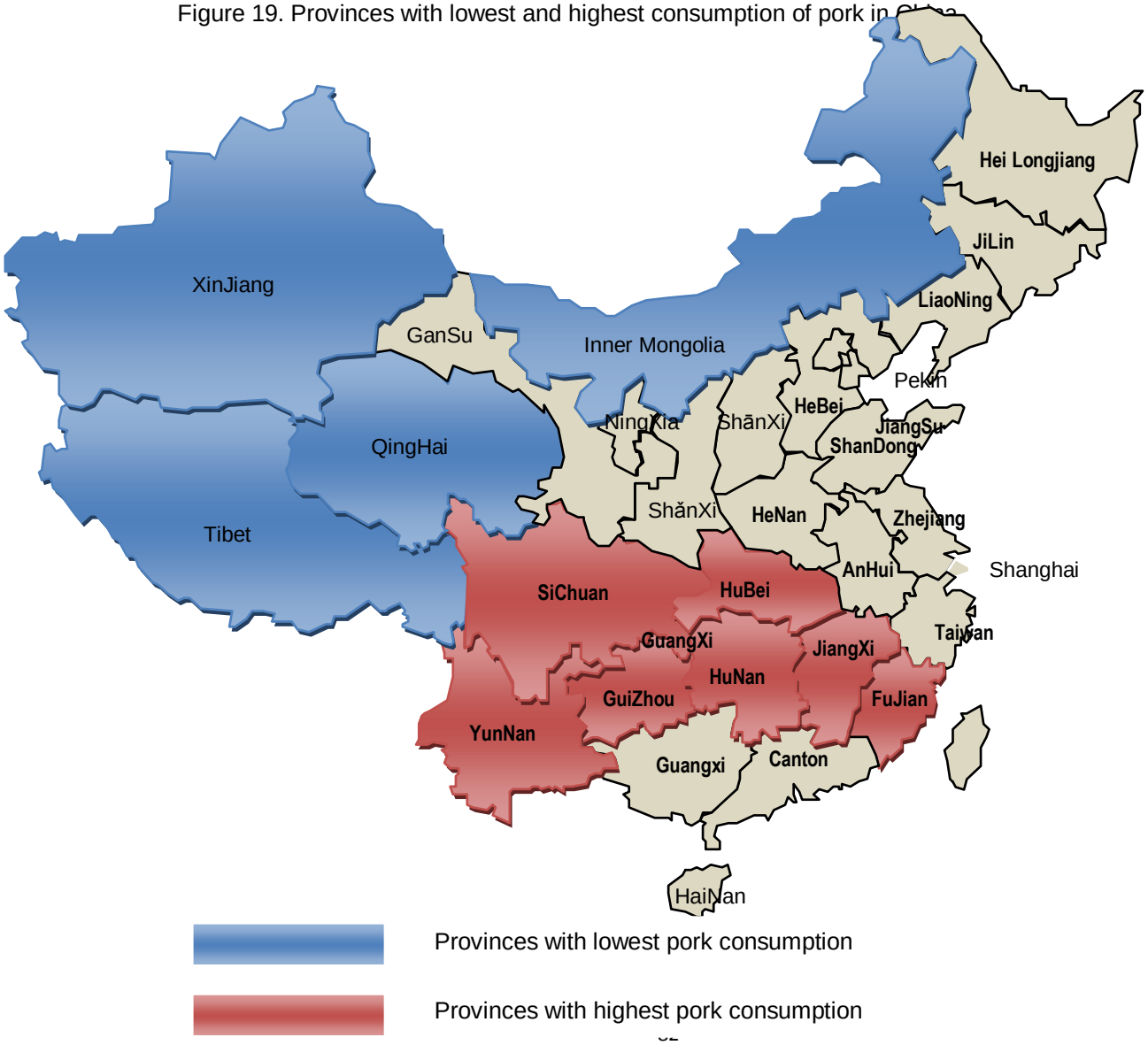


Table 15. Areas with less pork consumption in China in 2006

Area	Xinjiang	Ningxia	Tibet	Qinghai	Inner Mongolia	Beijing
Monthly average per capita consumption	0.51	0.67	0.88	0.98	0.94	1.43
Percentage in livestock (%)	20.3	31.4	27.98	35.12	43.06	46.10

Source: National Bureau of Statistics of China 2007

Table 16. Areas with most pork consumption in China in 2006

Area	Guizhou	Jiangxi	Hubei	Yunnan	Fujian	Sichuan	Hunan
Monthly average per capita consumption	2.11	2.01	1.67	1.90	2.29	2.24	2.02
Percentage in livestock (%)	20.3	31.4	27.98	35.12	43.06	46.10	62.73

Source: National Bureau of Statistics of China 2007

With the continuous improvement of people's living standards, chilled and frozen meat will gradually replace the hot fresh meat though hot fresh pork is still widely consumed in rural and suburban areas. Hot fresh pork is vulnerable to microbial contamination which will cause safety and quality problems, while chilled pork has got its recognition of consumers for its safety, quality, tenderness and delicious. With regard to price, the chilled pork is more expensive than the hot fresh pork due to cost of the accessibility of the frozen facilities. In recent years, with the rapid growth of supermarkets in rural towns, the sales of chilled and frozen pork have been increased.

Pork consumption features and trend

Pork consumption in China shows the following several features:

Firstly, the consumption of pork is positively correlated with income. Families with higher income consume more pork than those with lower income. The south eastern coastal area enjoys higher pork consumption than other areas of China.

Secondly, the main consumption areas are also the main hog production areas.

Thirdly, the difference in pork consumption between the urban residents and the rural residents is becoming smaller. The urban residents consumed 2.2 times of pork than the rural residents in 1981. In 2001, the difference was 1.4 times, while it was less than 1.3 times in 2005.

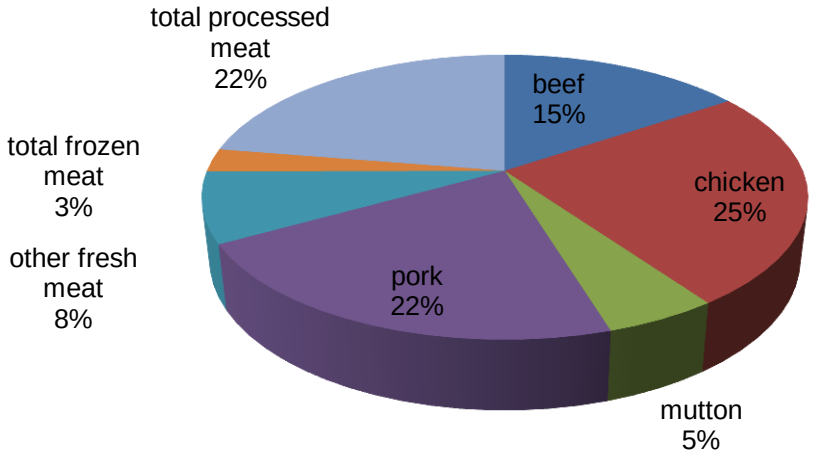
Spain:

Pork is largely consumed in Spain, both fresh pork and processed pork products are popular in Spain. The consumption of meat in Spain from the annual analysis of the

Ministry of agriculture in '*La Alimentación en España*' was 65.27 kg per capita in 2006, and the consumption of fresh pork per capita was 14.12 kg. Processed meat consumption was 14.64 kg, most of which is processed pork products.

From the figures 20 and 21we can see that fresh pork is the second largest fresh meat consumed in Spain following chicken, it accounts for 22% of the total meat consumption in 2006, and processed meat is widely consumed. It also accounts for 22% of the total meat consumption. Most of the processed meat is processed pork products such as sausages, boiled ham, boiled sausages and cured ham, and the percentages are 17.9%, 13.2%, 11.3% and 14.3% respectively. The consumption of pork shows an increasing trend from 2000 to 2006.

Figure 20. Composition of the meat consumption in Spain



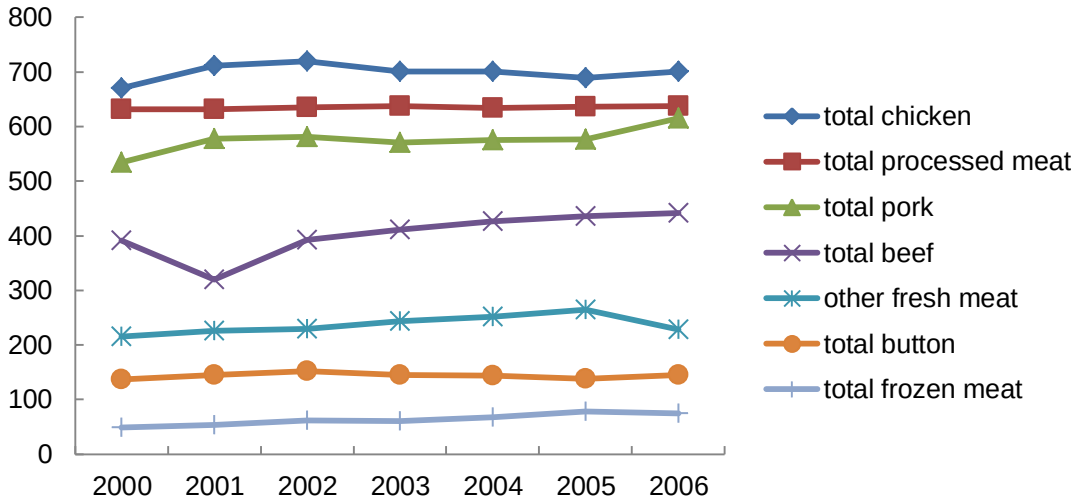
Source: La Alimentación en España, 2006

With regard to the consumption of pork in different areas in Spain, we can see from the following figure 22 that, the average consumption of pork in home per capita is 11.6 kg, and the regions which consume higher than national average level are *La Rioja, Galicia, Extremadura, Castilla y León, Castilla La Mancha, Aragón y Cataluña*. And the highest consumption of pork is from Extremadura.

The average level consumption of pork per capita in home in Spain is 11.6 kg while that of city is 10.1 kg, implying that the consumption of rural areas is no less than the consumption of cities, this could be explained that, compared with the income of the Spanish people, the price of pork is affordable and there´s no such a difference between the consumption of cities and consumption of rural areas in China. In China, the consumption depends a lot on the income of the people. In Spain, the big pork consumption areas are those who produce a lot of pork such as *Cataluña* and

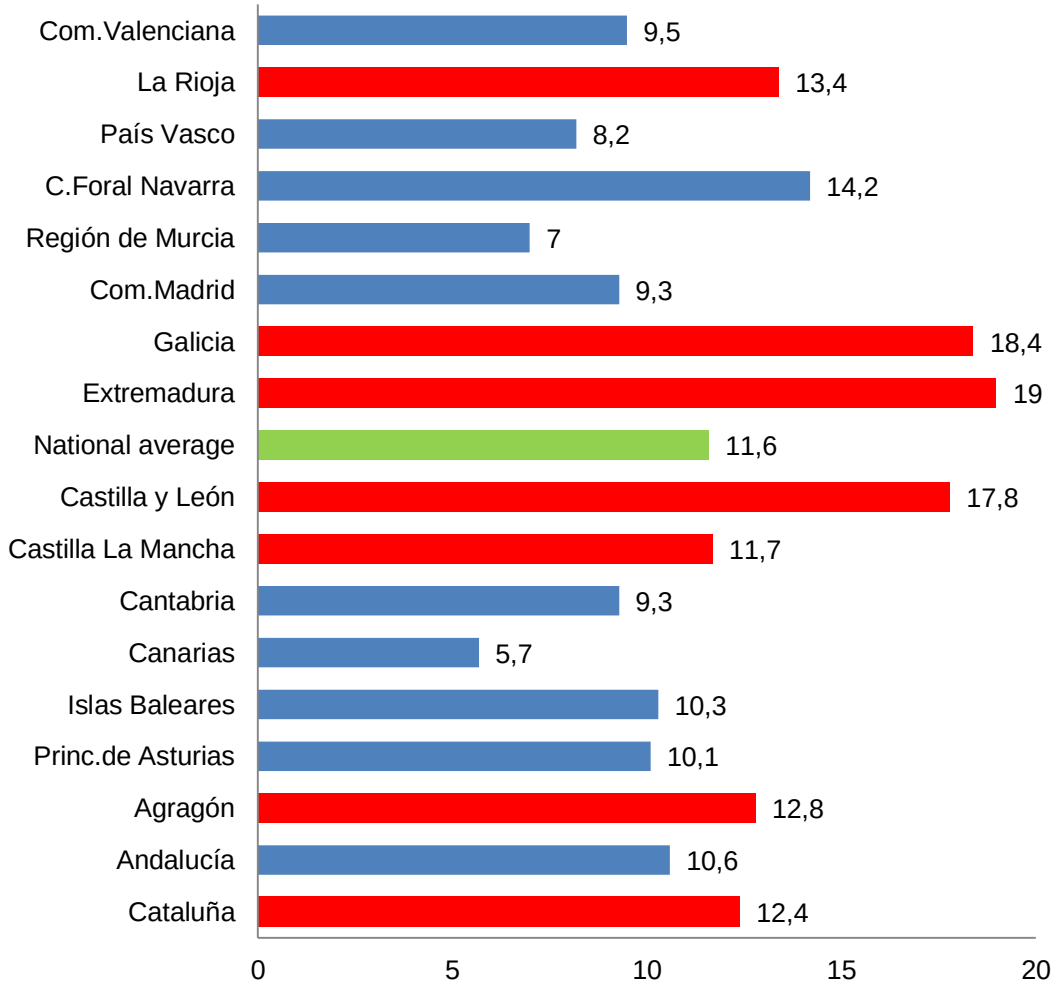
Extremadura.

Figure 21. Trend of meat consumptions in Spain Unit: Millions kg



Source: La Alimentación en España, 2006

Figure 22. Consumption of pork in home per capita in each auto community in Spain Unit: kg



Source: La Alimentación en España, 2006

It can be concluded the features of pork consumption in Spain as:
First, the consumption of fresh pork accounts a main part of fresh meat consumption, most of the processed meat products are pork products, if we sum up all the consumption of fresh pork and processed pork products, pork is the biggest consumed meat in Spain.

Secondly, the pork consumption has no obvious relationship with income. Actually, the big pork production areas are big pork consumption areas.

Thirdly, there´s no great difference in consumption of pork between urban and rural areas.

3.2.7 Pork International Trade

China
Due to substitution of poultry meat and pork offal imports, the import of pork products was quite low. In 2006, the turnover for pork import was 160 million US dollars, about 10.5% lower than 2005. Among the imported pork products, pork offal accounted for nearly 84%. The remaining part was fresh and frozen pork products. U.S. pork offal exports to China in 2006 increased by 12% to 33,422 metric tons, and exports through Hong Kong increased by 36% to 5,871 metric tons. Table 17 shows the major countries that export pork products to China (exclude imports through Hong Kong).

Although China is the world's largest pork production country, it is far from a significant player in pork export market, and export only accounted for 1% of China's total pork production. With regard to exporting countries, Russia used to be one of China's largest export markets. One reason for China's decline in export is the more strict export inspection and quarantine jointly executed by the Administration of Quality Safety Inspection and Quarantine, the Ministry of Commerce and China's General Customs Administration to control pork export to some EU countries.

Table 17. Main pork export countries to China Unit: kg

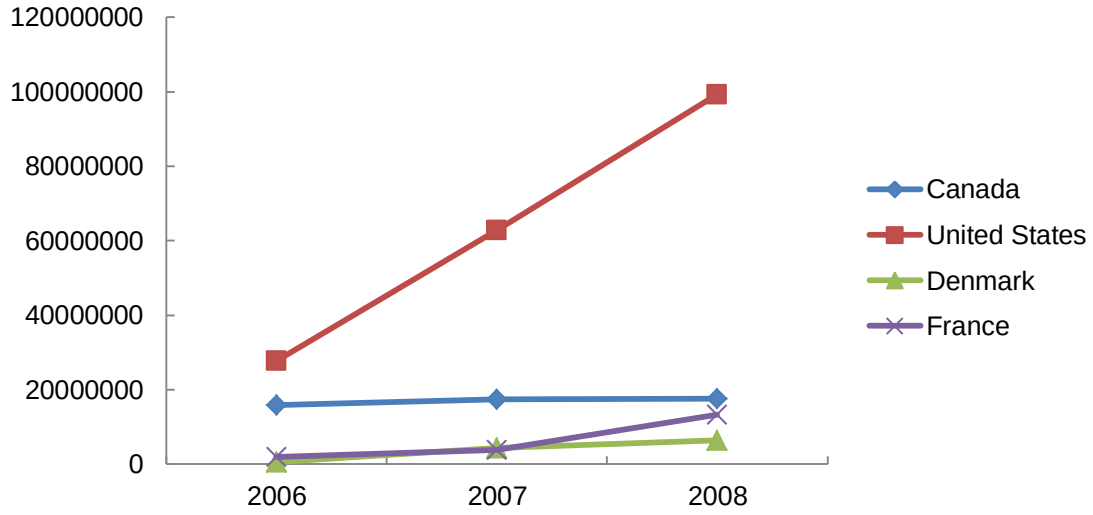
Origin	2006	2007	2008
Canada	15,866,803	17,423,140	17,627,127
United States	27,652,048	62,859,908	99,267,511
Denmark	628,201	4,318,884	6,444,868
France	1,992,800	3,741,500	13,286,300

Source: UNCOMTRADE, 2009

The presence of imported meat in China depends on the bilateral protocols of exportation that sign the countries which are interested in selling their products to China.

Nowadays, China has signed protocols to import pork from USA, Canada, France, Italy, Ireland, Denmark and Spain. There are several countries inside the process of signing up the protocol with China, such as Holland, UK, Finland, Belgium, Germany, Hungary, Slovenia, Poland and Spain (following General Administration of Quality Supervision, Inspection and Quarantine of P.R.C. (AQSIQ) data). The protocol signed up between China and Spain is attached in the annex of this paper.

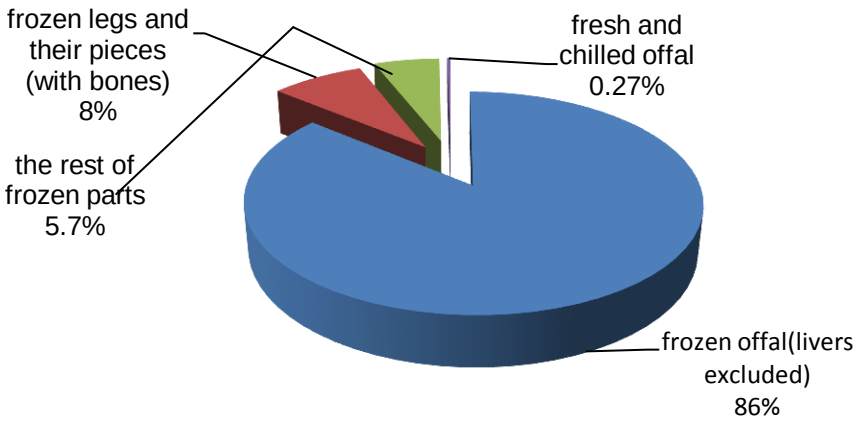
Figure 23. Pork imported of China from different countries



Source: UNCOMTRADE, 2009

With regard to the imported pork products from the world to China, we can see from the figure 24 that more than 80% of the pork imported is offal.

Figure 24. Different types of imported pork products and their percentage from the world to China



Source: World Trade Atlas data, 2006

Spain:

The pork export and import of Spain are increasing, 43% of its exports go to European countries, and 50% of its imports also come from European countries, imports and exports with third countries are much less than that with EU members (see table 18). The exports of pork from Spain mainly go to the European countries such as France, Netherland, Germany and Italy and to non-European countries mainly to Russia (25%), Japan (15.91%), Hong Kong (7.3%) and Korea (6.09%) (See table 19).

Table 18. Pork imported to Spain from other countries in 2005

Countries	Millions tons	%
Croatia	2,113	10.23
United States	3,472	16.80
Norway	2,932	14.19
Switzerland	4,929	23.86
Rest	7,216	34.92
Total	20,662	100

Source: MARM, 2009

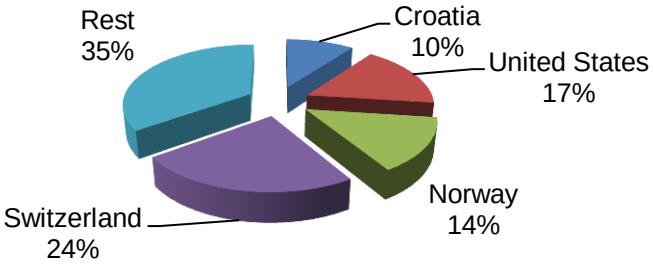
Table 19. Pork exported from Spain to world in 2005

Countries	Millions tons	%
Angola	34,350	1.79
Belarus	48,366	2.52
Bulgaria	38,368	2.00
China	70,670	3.68
South Korea	116,708	6.09
Croatia	58,027	3.03
United States	73,378	3.83
Hong Kong	139,403	7.27
Japan	305,143	15.91
Romania	193,658	10.10
Russia	481,889	25.13
Ukraine	45,198	2.36
Rest	312,758	16.31
Total	1,917,916	100

Source: MARM, 2009

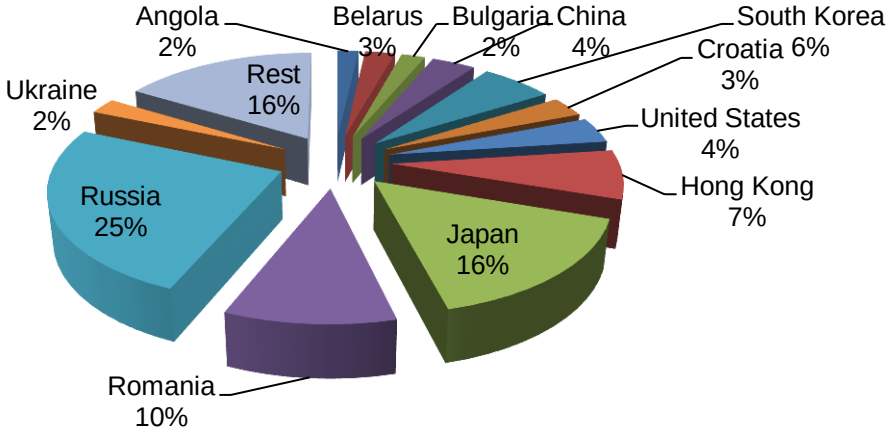
Pork exports from Spain to the world accounts for 7.37% of pork exports from Europe to the world. More than 50% of the Spanish exported pork and pork products are hams, which are also very popular and well-consumed in its domestic market, 28% are edible offal and 20% are carcasses (fresh pork) (figure 25, 26 and 27).

Figure 25. Pork imported to Spain from the world



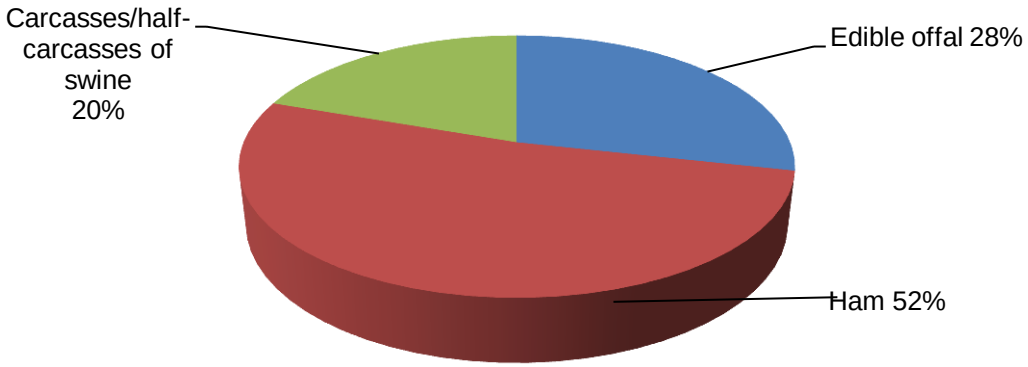
Source: MARM, 2009

Figure 26. Pork exported from Spain to the world



Source: MARM, 2009

Figure 27. Percentage of pork products exported from Spain to the world



Source: UNCOMTRADE, 2009

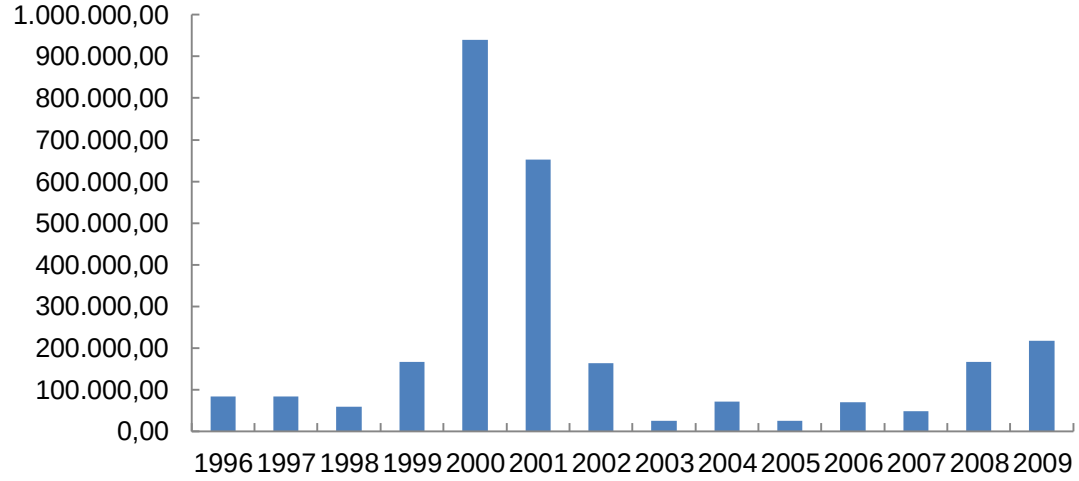
The pork trade between China and Spain

Since 1990s, China started to import pork and its products from different countries in the world such as United States, Canada and Brazil (UNCOMTRADE, 2009). Before the agreement of importing pork from Spain was signed between General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (AQSIQ) in China and MARM in Spain in November, 2007 (MARM, 2008), the Spanish pork existed in the Chinese market was imported from Spain to China via Hong Kong. Therefore, the main Chinese market of Spanish pork was Hong

Kong as the two countries did not have the legal channel to import (Illán, 2007).

From the figure 7.19 we can see that there's no clear trend of the export and import between the two countries. Actually, the pork exported from Spain to China only accounts for a little part of the pork exported from the world to China, there are problems existing in this international chain which will be analyzed in the last part of this paper.

Figure 28. Pork export from Spain to China



Source: Secretaría De Estado De Comercio, Ministerio De Industria, Turismo y Comercio
Type of product: 0122 carne de ganado porcino, Fresc
http://datacomex.comercio.es/principal_comex_es.aspx

3.2.8 SWOT analysis of the sector

China:

Strength：

(1) Low production cost, especially cheap labor
(2) Booming economy: from 1979-2004, the annual growth rate of GDP was on an average of 9.4%
(3) Increasing investments in swine production and disease control
(4) Increasing attention for environment and animal welfare: authorities at various levels have realized the environmental problems

Weakness:

(1) Food safety and quality problems
(2) Fragmented development in major stages of the pork chain
(3) Slow in technology upgrading and limited investment from the sector in R&D

(4) Poor logistics management
(5) Poor waste treatment
(6) Under-developed quality management and traceability system
(7) Low efficient institutional and governmental system

Opportunities:
(1) Pork still dominates meat consumption in the next decade, consumption in rural market is increasing
(2) Increasing collaborations between educational and research institutes
(3) Increasing focus on integrated chain management in large companies

Threats:
(1) Increasing feed cost
(2) Increasing competition in the sector
(3) Uncertainty in swine production
(4) No sound solution for sustainable waste treatment

Spain:

Strengths:
(1) Spain is the second producer in Europe and the fourth in the world
(2) Epidemic diseases are under control
(3) Meat production is a leading sector in Spain
(4) The sector has advanced in the speeding of obtaining sanitary exporting certificates which is one of the most important barrier for exporting
(5) The production chain has very high standards on traceability, animal welfare and hygiene in order to adapt to the exigencies of European consumers. Certifications is widely adopted
(6) Processed products have its regional markets very well developed

Weakness:
(1) Lack of human labor and high cost of labor
(2) High cost of raw materials, such as feed as feed does not have subsidy from the government
(3) Impossibility of increasing the price of the products, especially of fresh pork meat (Buxadé, 1994)
(4) Reduced number of associations of professionals in the sector

(5) Some of the commercial network are not transparent (Buxadé, 1993)
(6) There is a decrease in consumption of pork products

Opportunities:
(1) There is a world demand in countries that consume pork such as China with whom has been sign an agreement of exporting, with a great interest for fresh meat exporters and cured ham industries
(2) Availability of emigrant labor force due to the immigrants that are coming to Spain
(3) Establishment of proposals in order to help companies to export
(4) Development of new products of added value adapted to new necessities of Spanish consumers in terms of health and convenience

Threats:
(1) Increase of cost of inputs
(2) Measurements in the area of the WTO that can cause the entering of huge quantities of pork meat in European countries at lower prices that the prices of production of the European farmers
(2) Increase of costs derived from legislations in the EU
(3) Deformation en the sector in subjects such as animal welfare

3.3 Comparisons of the pork chain management in Spain and China

3.3.1 Description of the pork chain types in China and Spain

Before doing the comparison of the pork chain management between China and Spain, it is necessary to describe the pork chain types in China and Spain to define the comparison scope.

Spain:

There are two different chain types in Spain, which are “White pig chain” and “Iberian pig chain”.

The “White pig chain” refers to a pork chain that produces pork and cured ham with white pigs. The “Iberian pig chain” refers to a pork chain that produces pork and cured ham with Iberian pigs.

The main differences of the two chains are as follows:

- Breed. In “fresh pork chain”, white pig breeds such as large white, landrace, Duroc, Pietrain, Blanco Belga and Hampshire are used; while Iberian pig is used in “Iberian cured ham chain”, Iberian pig is a unique breed which has three different types: 100% pure Iberian breed, mixture with Duroc-Jersy (75%) and mixture with Duroc-Jersy (50%), the different types of breeds will produce different class of Iberian ham.
- Production system. For white pigs, the production system is intensive, whereas in the case of Iberian pigs, there is a part of extensive production.
- Feed. The white pigs eat the normal feed which is mixed with maize, wheat, soybean, barley, fiber and other nutrition; while the Iberian pigs eat acorns (bellota), mixture of acorn and feed (recebo) and feed (cebo).
- Location. The production of white pigs is concentrated in the area of *Cataluña*, *Aragon, Castilla La Mancha*; while the extensive production of Iberian pigs concentrate in the area of *Extramandura*, where produces the acorns and meadow (dehesa).
- Processing period. The process of Iberian ham production takes between two and three years, depending of the feeding of the animal and the curing process; while the process of fresh pork is much shorter, it takes 5 – 7 months for the pigs to be slaughtered.
- Quality system. Iberian cured ham is a particular product from a special origin, there are PDOs in this area to give special certifications to Iberian cured ham through monitoring the whole pig producing process in the area.
- Chain integration. There is a higher percentage vertical integration in “fresh pork chain”, while there is a higher percentage of horizontal integration in “Iberian cured ham chain”.

China:

In China, as we explained before, most of the pig production comes from small household pig farming, while several big pork processors initiate chain integration. Cured ham is not such a particular product in China, so we don’t define pork chain into different types.

As the two chains in Spain differs a lot in chain management, which includes governance, information exchange etc., in the following comparison section of pork

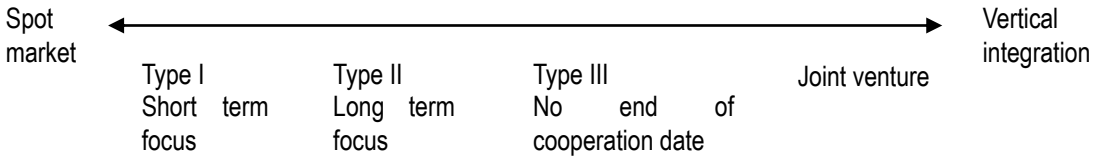
chain management between Spain and China, we will focus only on the comparison between supply chain management in “white pig chain” in Spain and supply chain management in China’s pork chain to make the comparison make sense as it is explained in the very beginning of the work.

3.3.2 Governance of pork chain in China and Spain

Within a supply chain, buyer-supplier relationship might take various forms. Two different schools of thought can be distinguished in literature on business relationship management (Cousins, 2002). The first is the behavioral or humanistic school which compares relationship between firms as relationship between people like a marriage, based on trust, commitment, mutual understanding and cooperation. The second school takes an economical perspective in which relationship between firms based on power difference in size of firms and their economic power in the market.

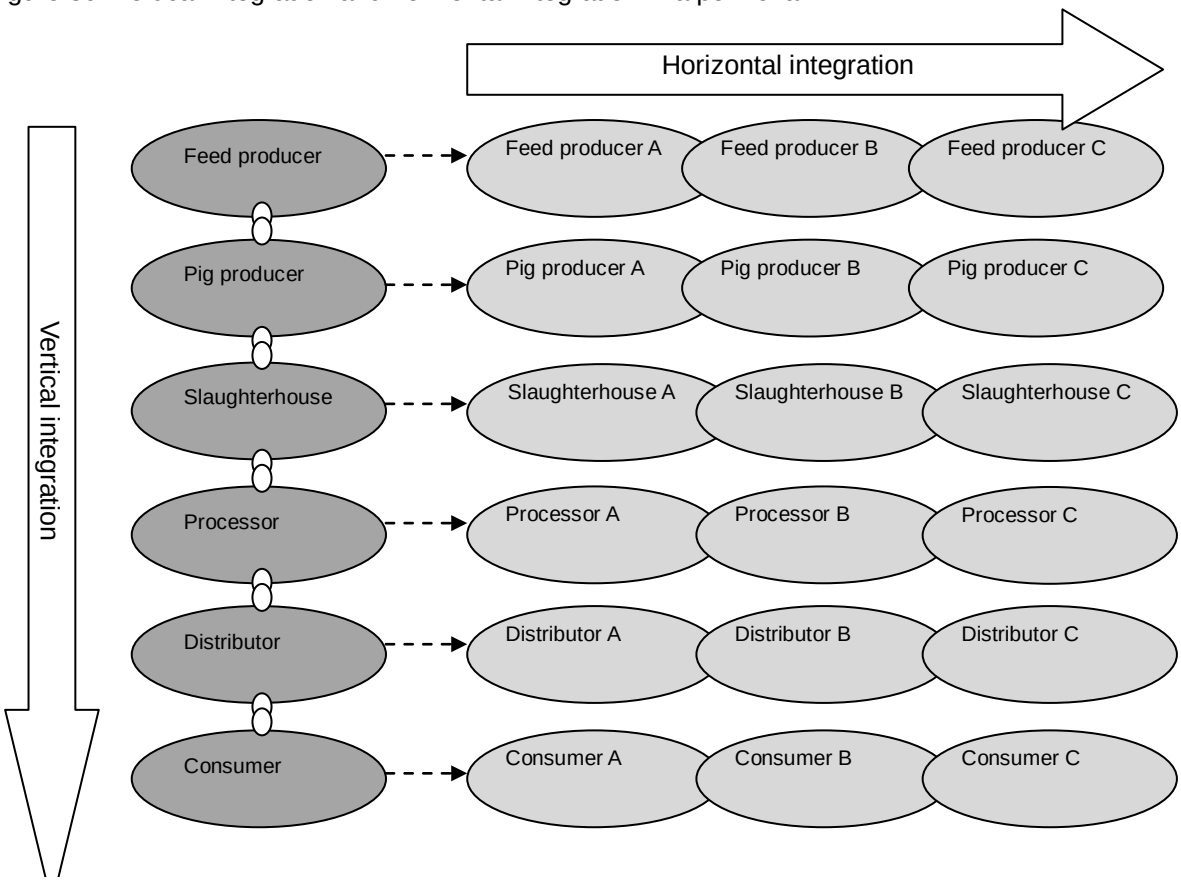
The author will use transaction cost theory, which is used by many authors for drawing up a continuum of types of relationships between companies in a supply chain, beginning with market transactions and ending at vertical integration (Cox, 1996; Lambert et al., 1996; Slack et.al., 1998; Spekman et al., 1998; Van der Vorst, 2000; Claro, 2003; Verdujin, 2004) (see figure 29). Between these two extremes several types of hybrid relationships differ from author to author, but the characteristics of buyer-supplier relationships overlap to a large extent across authors (Verdujin, 2004).

Figure 29. Continuum of buyer-supplier relationship



Source: Cox, 1996; Lambert et al, 1996; Slack et al, 1998; Van der Vorst, 2000; Claro, 2003; Verdujin, 2004

Figure 30. Vertical integration and horizontal integration in a pork chain



Vertical integration: integration of different levels of chain

Horizontal integration: integration of same level of chain actors

Source: drawn by the author

1. Spot market relationships represent market transactions as positioned by Williamson (1985). The fundamental assumption is that trading partners are interchangeable.

2. Type I (short term focus). The firms involved recognize each other as partners, and on a limited basis coordinate activities and planning. The partnership has a short term focus.

3. Type II (long term focus). The firms involved progress beyond coordinated of activities to integration of activates, the partnership has long-term horizon.

4. Type III (no end of date). The firms share a significant level of operational integration and view each other as extension of the own firm. No end date for the partnership exists.

5. Joint ventures are new created and independent firms separate from the companies forming the alliance. Power in the relationship is based on equivalence.

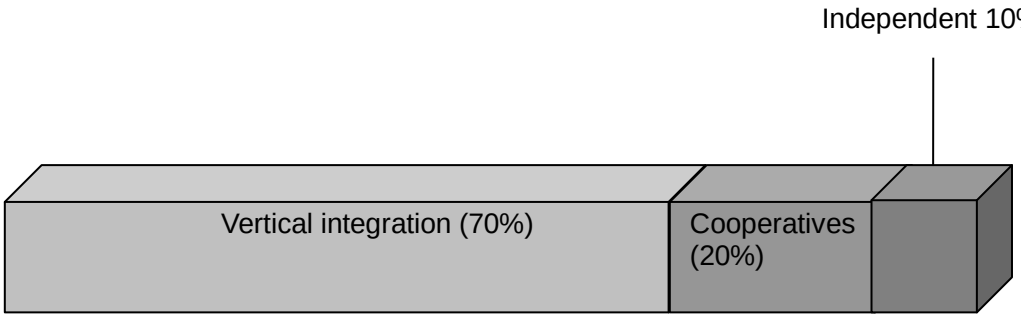
6. Vertical integration or the merger of parties in (part of the) supply chain. In this case all (or part of the) activities from sourcing raw materials to delivering the products to end consumers and supporting activities are coordinated by one firm.

On the other hand, besides vertical integration, there is horizontal integration among the same level of chain actors (see figure 30).

Spain:

The pork chain governance in Spain has mainly two manners, which are vertical integration and horizontal integration.

Figure 31. Form of chain governance in Spain



Source: drawn by the author

In white pig chain, the vertical integration dominates the chain governance form, 70% of the production comes from vertical integration, 20% of the production comes from cooperatives (horizontal integration) and the other 10% is independent (figure 31).
In white pig chain, the main integrators are feed producers of the chain, they started to integrate with their downstream actors of the chain since 30-40 years ago in the form of providing feed and production farm yards to the pig producers, after this first step of integration, they started to integrate with other chain actors such as slaughterhouse and processing industries, through doing this, the integrator becomes a big company that integrates the whole chain from feed producer until cured pork products processor.

The benefits of vertical integration form are:

1) Pig producers reduce their risk in epidemic diseases of the pigs

2) Pig producers reduce their risk in the change of feed price
3) Pig producers receive all kind of service provided by the integrator, including veterinarian, technology, information of the market, etc.
4) Integrator is able to control all the process of producing pigs, including feed, selection of breeds, veterans, quality system, technology, information, finance, etc. it is easier for them to trace the quality of the products as well.

In the form of vertical integration, the pig producers become the workers of the integrated company, they lose part of property when they were producing pigs for themselves, they were responsible for all the benefits they got and the risks they faced, but now they don't have the property of producing pigs, the risks are transferred to the integrated companies, but the benefits they get also become a fixed part which is their salary that is not related with production of pigs.

In Spain, there are several big integrated companies such as *Campofrio, Grupo Alimentaria Guissona, Vall company, ElPozo* etc. who have conducted vertical integration successfully for many years, these companies have successfully controlled the safety and quality of their products and make themselves leading companies in the whole Spain. The company *Elpozo*, which locates in Murcia, south of Spain, is the one of the leading meat industry in Spain. It is one of the typical companies that conduct vertical integration. It has formed its concept of Integrated Process control (IPC) and considers it as its main strength in responding to the needs of consumers and offering products surpass their expectations. It integrates from feed production, veterans, pig production (which includes white pig production, Iberian pig production), slaughtering, deboning, classifying the products into different categories, processing and logistic systems. In the whole process, the company strictly controls the safety and quality of every link, which make it renowned company in Spain with the image of offering products with safety, quality and variety (see figure 32).

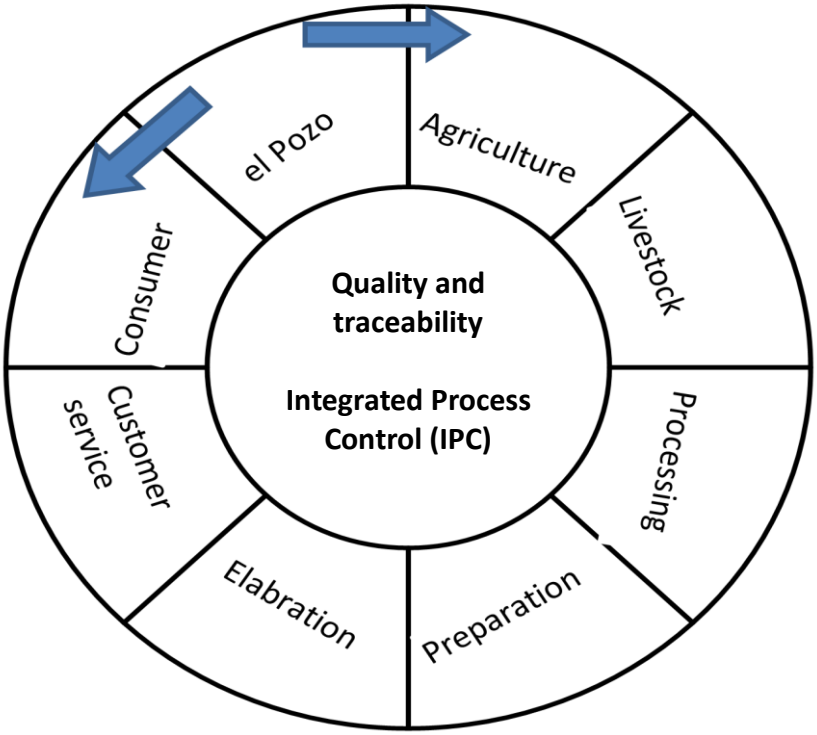
Vertical integration achieves its importance in Spanish pork chain for several reasons as follows.

First of all, the risk of feed price makes pig producer in need of a form to share risk. Spain is a country that has a dry climate, which makes it difficult for the country to produce a lot of maize. It imports a lot of maize which is one of the main raw materials to produce feed. For this reason, the feed price in Spain depends a lot on the imported maize price, which raises the risk for the pig producers. To reduce the risk, the farmers

need a unity that could bear more risk and to be protective.

The second reason is the risk of animal disease. Spain has past pig African fever in 1970s which was transmitted from Africa through the boundary between Spain and Africa, making a lot of loss to the pig producers, at that moment, epidemic risk was serious and the pig farmers were in great need to find a manner to avoid risk, and vertical integration arises from there.

Figure 32. Vertical integration of El Pozo



Source: www.elpozo.es

But some experts view that it is also considerable that external risks (such as economics crisis of the world) will make the big integrators in risk or go bankrupt, it will cause great loss to the whole chain as it is highly integrated with so many years' development and so many employers in the integrated company.

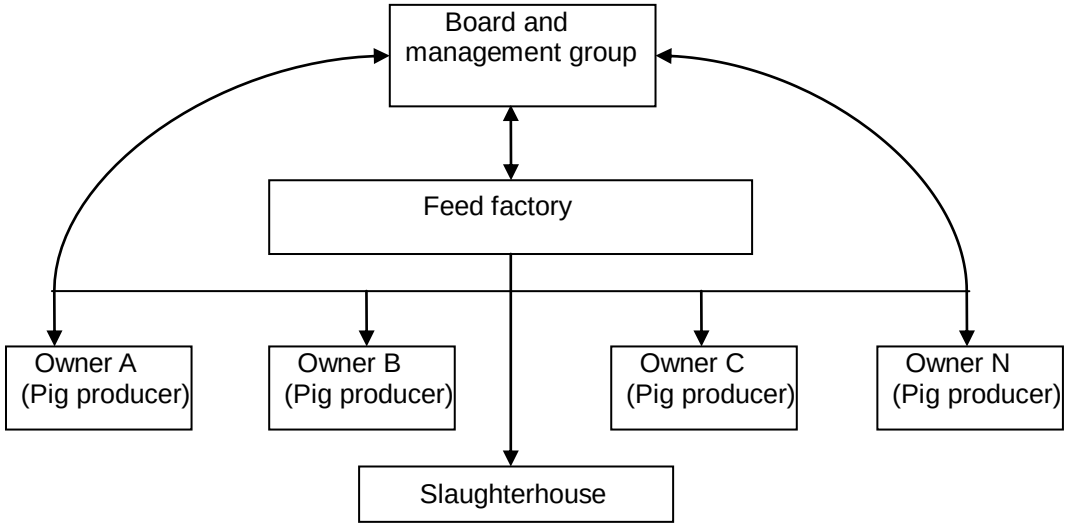
But anyway, choosing vertical integration in pig sector in Spain is the problem of risk and history.

Besides vertical integration, the horizontal integration such as cooperatives emerged as another form of integration in pig sector in Spain as for its own advantages. Actually, according to the views of experts, cooperatives dominate the chain integration

manner more in almost all the other countries in Europe except Spain.

The author investigated several cooperatives in pig sector in the *Cataluña* zone, which have called some attention. The cooperative D'IVARS is a cooperative of feed in *Lleida*, it has nearly 2000 members, each member invests a certain amount of their products or capital according to his or her capability, using the capital invested and products by the members, the cooperative reaches a bigger scale, it creates factories to produce feed and it sells the feed to their members, in other words, they produce feed for themselves, each member works for himself, they are responsible for their own business.

Figure 33. Structure of a feed cooperative



Source: Ji etc., 2010

As Cook (1995) described, the agricultural cooperatives today are attempting to be “offensive”, organizationally complex, user-investor driven and increasingly exclusive. In this feed cooperative, the members are like shareholders of the factory, but the factory is not a S.A or S.L because of the decision right, in a S.A or a S.L, the decision right depends on the capital share the shareholder holds, the more capital share it holds, the more decision right it has. On the other hand, in a cooperative, each member only has one voting right, that is to say, decision right is not divided according to the amount of investment. The cooperative has a board which is a management group that is the representative of the owners and is responsible for the running of the cooperative; it is consisted with manager, boarder chief, veterans, etc. As the same time, the members of the cooperative are pig producers, they purchase the feed produced by their cooperative to raise pigs, cooperative is responsible for looking

channels to sell pigs for their members. The basic running manner of a feed cooperative is described in figure 33. In the area of *Lleida*, there are many other cooperatives of in poultry and cattle sector, the way they operate is more or less the same with the feed cooperative D'IVARS described in this part.

The main cooperatives in pig sector in Cataluña zone are listed in the following table 7.18.

The benefits of cooperatives are:

1) A cooperative gets scale economy
2) Members of a cooperative allocates the risks through cooperative
3) Management group offers information, service to their members and members decide how to develop the cooperative themselves
4) The cooperative is able to control and trace the quality and safety of the producing products

Table 20. Cooperatives in pig sector in Cataluña zone

Name	Location	City
Agropecuària Catalana	Sant Fruitós de Bages	Barcelona
Agrària Plana de Vic i Secció de Crèdit	Vic	Barcelona
Agrària Comarcal del Vallès	Les Franqueses del Vallès	Barcelona
Agrària de Torelló,	Torelló	Barcelona
Copaga	Lleida- Polígon Industrial el Camí dels Frares	Lérida
Linyola Agropecuària i Secció de Crèdit	Linyola	Lérida
Cotecnica	Bellpuig	Lérida
Del Camp d'Ivars d'Urgell i Secció de Crèdit,	Ivars d'Urgell	Lérida
Camp i Secció de Crèdit Sant Isidre de Bellcaire d'Urgell,	Bellcaire d'Urgell	Lérida
Agropecuària i Secció de Crèdit d'Artesa de Segre	Artesa de Segre	Lérida
Agropecuària Coperal i Secció de Crèdit,	Santa Coloma de Queralt	Tarragona

Source: cooperativa agraria

The president of Pigs' sector Council of Confederation of Agricultural Cooperatives in Spain has done a comparison of the two forms of integration (vertical and horizontal) in Spain in terms of efficiency, risks and property according to his opinions.

Efficiency: As we can see, the vertical integration has a long history of development in Spain, it has a high efficiency in controlling safety and quality of the products and it has achieved this goal successfully through integrate every link of the chain into a

single company, through which it could monitor the whole process of chain. On the other hand, as it is a company held by several big stakeholders, decisions could be made quickly without too much negotiation because the employees do not have a lot of right of speaking. While in cooperatives, it also controls the safety and quality well, but it takes more time to do a decision as it should negotiate with a lot of small owners of the cooperative, it creates more transaction cost.

Risks: for the two forms, both them reduce the risk for the pig producers, in vertical integration, the pig producers become the employers of a company, the risks they took are almost transferred to the integrator while the integrator bears a lot risk, though the integrator has a strong capital ability in resisting risks, when it encounters big risk such as financial crisis of the world, it will suffer a great loss. All the employers as well will face the underemployment situation. On the other hand, in cooperatives, the small owners transfer risks to the cooperative, but when one or two of the owners face risks or crisis, it will not affect the whole performance of the cooperative, and the cooperative can give timely help to the owner who is in risk.

Property: properties are different in the two forms of integration. In vertical integration, the property is concentrated in the integrator, while in cooperative, the property is dispersed to all the members, that is to say, each member has its own property of the cooperative, and no matter it is big or small.

With regard to the governance between other actors in the chain, it is found that the relationship is not tight. Each actor of the pork chain link always face lots of suppliers and lots of clients, they don´t have written contract with each other featuring that they do business daily according to the price and quality offered by their suppliers and clients.

But curiously, although they don´t have written contract, some of them clarify that they have been doing business with their supplier/client more than 20 years without change, which indicates that the relationship is long term and stable based on a trust like neighbourhood.

China:

Traditional Chinese pork chain has a lot of links between pig farmers and slaughterhouse, as shown in Figure 7.25. As we have mentioned before, there are pig brokers called *“fàn zi”* running in China's vast rural areas, the first-level brokers

shuttling between “pig suppliers” and “pig farmers”, they play the role of middle man by purchasing the pigs from the large numbers of pig farmers and selling them to pig suppliers, the second level pig brokers are responsible for providing the information of pig source, the “pig suppliers” have the right to sign contract with slaughterhouse to sell the pigs they collected. More than 66% of the pig farmers sell their pigs to pig brokers (Dai, 2003).

As the origin of the pork chain, the governance form between farmers and slaughterhouse is the key that affects pork safety and quality, there are several defects that could influence the governance of the chain, which are:

1) Information asymmetry and adverse selection

When the governance generates information asymmetry between pig farmers and slaughterhouse, the farmers tend to select adverse selection in the form of hiding quality and safety problems of their pigs, which will cause potential safety problems.

2) Level of control

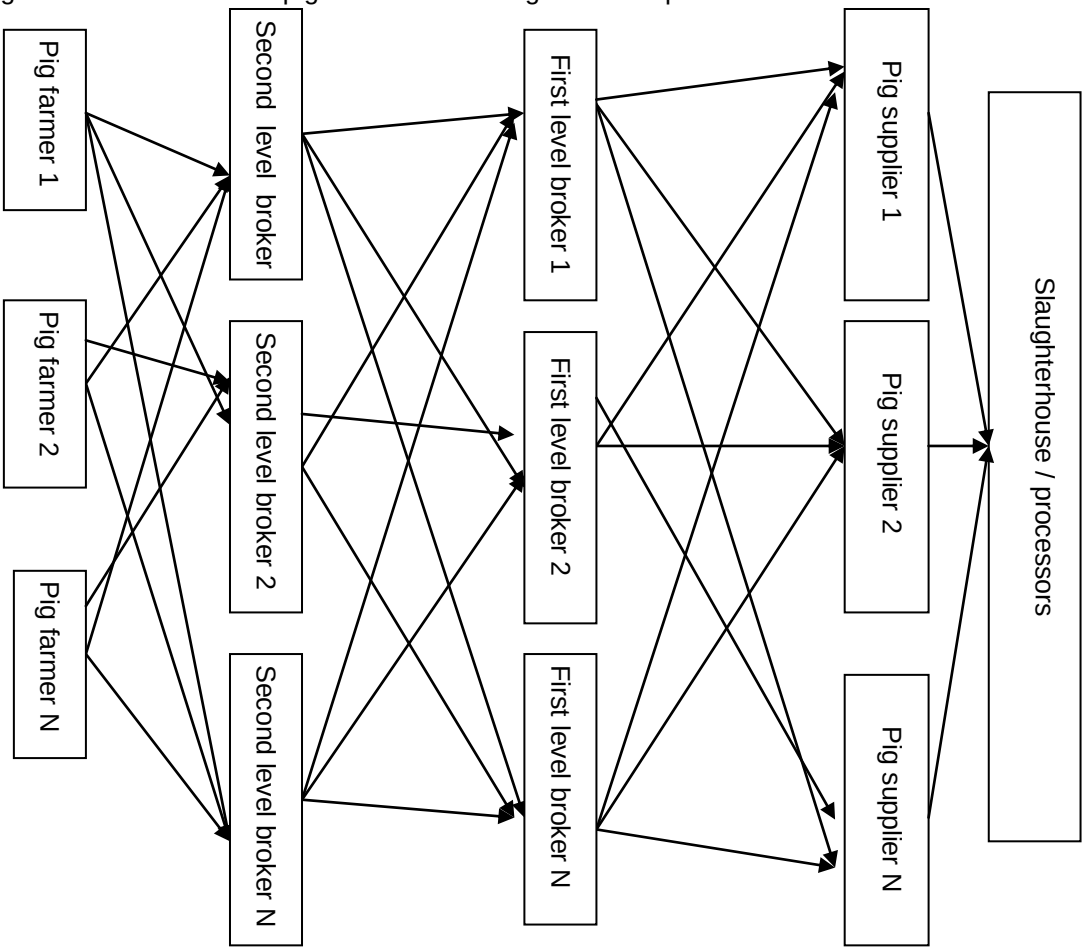
When the choice of governance is just the control of quality and safety in terminal point instead of a whole process control, there will be potential dangers exist

3) Monitor cost

When the choice of the governance gives a big monitor cost, the level of monitor tends to be decreased and the control tends to be low efficient.

From figure 34 we can see that on the one hand, the connection between pig farmers and pig brokers and the connection between pig brokers and pig suppliers are simply a loose relationship. Different brokers purchase pigs from different pig farmers and various pig suppliers purchase pigs from various pig brokers. Pig suppliers know from which pig broker the pigs come, but obviously they don’t know from which pig farmer the pigs come, in other words, they are not able to trace this process. Furthermore, asymmetric information exists among the pig farmers brokers and suppliers, if the pigs raised by pig farmer have safety or quality problems, which has caused many pork safety accidents, they will tend to choose adverse selection, hiding potential problems. While the broker, will also hide the safety and quality problems to pig suppliers, giving hidden troubles to pork safety.

Figure 34. Links between pig farmers and slaughterhouse/processor in China



Source: drawn by the author

In addition, as the pig farmers in China are scattered, they use different veterinary drugs and different standards that lead to pork quality and safety risks.

The Chinese consumers' demand for pork quality and safety is increasing, and the government is paying much more attention to food safety these years. Several big Chinese pork processors have tried to integrate with farmers in different forms (Sun, 2006), which are:

① Designated Slaughterhouse Mode

② Company + pig farmers Mode

③ Company + production base + pig farmers Mode

④ Company + cooperative + pig farmers

⑤ Integrated Group Mode

These five modes to some extent have improved pork safety and quality, but each one has its drawbacks in different aspects:

① Designated slaughterhouse mode

Designated slaughterhouse mode refers to "designated slaughter, centralized quarantine". From slaughtering of pigs to the sales of pork in the market, the entire process should go through the quarantine of its origin, inspection of road station, inspection, quarantine of abattoir and quarantine of the market (Sun, 2006). The safety and quality of pigs could be controlled between finished pigs and slaughtering, but the raising process of pigs could not be detected, which includes the feed, veterinary and so on. For this reason, it still cannot fully guarantee the safety and quality of pork.

②Company + pig farmers Mode

In this mode, company (slaughterhouse or processor) provides the pig farmers feed, piglets, veterinary medicine to control the producing process. However, it raises the monitor cost of the company, furthermore, as the pig farmers still raise the pigs dispersedly in rural area, it is difficult to implement standardization among them.

③ Company + base + pig farmers breeding Mode

In this mode, the company plays role as a leader, constructing pig production base for pig farmers, forming a "risk-sharing, benefit-sharing" community with pig producer. Among them, the company is not only a slaughtering or processing enterprises, but also a provider of feed and pig breeds; the production base is consisted with the company or veterinary which are financially capable, it is responsible for driving and guiding the household pig producers, who raise pigs in the production base (Shao, 2006). This mode is a whole process monitor which is able to control the safety, and the relationship between pig producer and the company is not a one to one relationship as they are connected by the production base. But the problem is the pig producers don’t have a common producing standard required by the company.

④ Company + cooperative (or association) + pig farmers Mode

Cooperatives exist in China, but the form is quite simple and it still does not have its importance. The cooperative is more like an association instead of a cooperative in Spain. It provides its member service on raw materials, feed, breeds, quarantine, and pig sales, organizing the pig producers and company. This mode has its advantages

in many aspects, such as a good control, standardization etc. But in reality its function, running manner needs to be developed.

⑤Integrated Group Mode

The mode combines all the production of pigs, slaughtering and even selling together. This is vertical integration done by several big pork processors in China such as *Yurun, Jinluo* and *Shuanghui*, they have their own production base, slaughterhouse, processing industries, and brand chain stores.

But the problems exist in these industries in China.

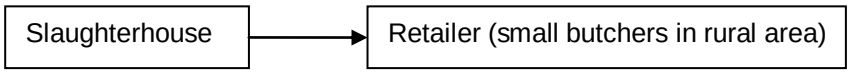
Firstly, they are expanding so rapidly that they don't have enough pig resources from their own productions. As a result, they collect pigs from small household farmers, specialized pig producers and pig suppliers to complement the supply. In this way, part of pigs' production could not be monitored as the production process of the farmers is out of sight.

Secondly, they have a lot of branches in different provinces and cities while they don't have a good control over the provinces and cities, each branch uses its own norms of producing and their own source of pigs. That's why a pork safety accident happened in *Yurun* of its *An Hui* branch in 2009, which damaged the whole image of *Yurun* Group. This kind of problem also exists in milk industry in China. For these reasons, although the company has adopted integrated strategy, pork safety is not assured.

(2) Governance between pork slaughterhouse/processors and retailers

The governance of original links is the key in the chain to guarantee the safety and quality of pork. However, the governance among the links of slaughterhouse, processor and retailer will also affect the safety and quality of final products; there are mainly three types of the governance of this link in China.

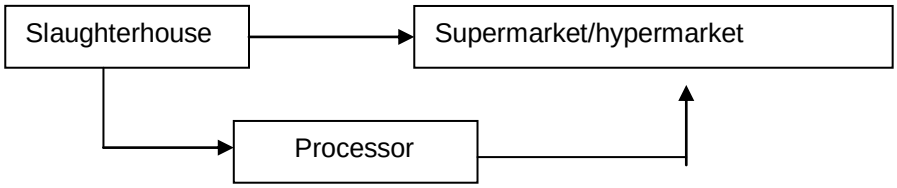
a) Spot market relationship between slaughterhouse and small butchers



In china, one of the governance forms between slaughterhouse and retailer is the spot market relationship. After slaughtering the pigs, the slaughtered pigs are sent to small butchers in *"Nóng mào"* market to be deboned and sold directly to the consumers. Between the slaughterhouse and butchers, there's no stable or strong relationship,

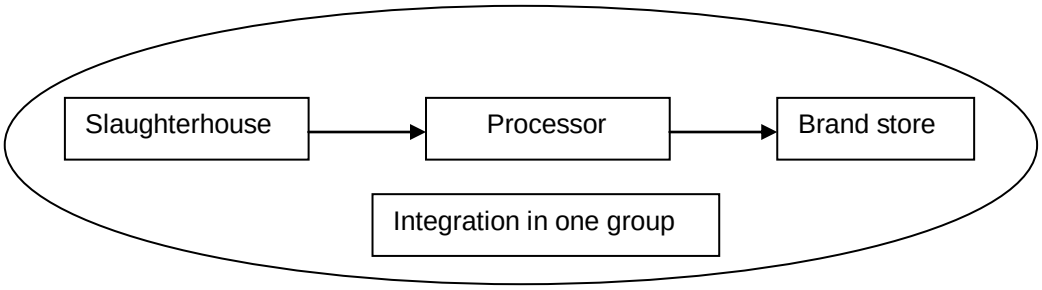
which is loose and temporary, the small butcher are not able to assure the safety and quality of the pork they sold, which gives potential problems to pork. This kind of governance is still popular in vast rural area and suburban area.

b) Alliance between slaughterhouse/processor and supermarket/hypermarket



Big slaughterhouse/processor companies in China have long-term relationship with supermarket/hypermarket; they sign the contract or establish commercial alliance so that the big company have a special space in the supermarket to sell their products. As the company has to maintain good quality of their product to keep the contract with the supermarket/hypermarket, the safety and quality of the products are assured. This kind of governance of the chain develops rapidly in big cities, 60% of the pork purchased in Nanjing is through supermarket.

c) Integration between slaughterhouse/hypermarket and retailer



Big pork companies, such as *Yurun, Jinluo, Shuanghui, Sushi and Zhongpin* have their own slaughterhouse, processing industry and brand chain stores integrated in one group. The food group Sushi has its own commercial group in doing commercialization of its products.

3.3.3 Information use and exchange in pork chain in China and Spain

The information use and exchange include the information change manner between different links, which indicates the form, frequency, adequacy among the key information exchange players and the direction of information flows. The information asymmetry directly affects the quality and safety of food, while it happens quite often in pork chain. The possible reason is that pork chain is quite long compared with other agri-chain, such as vegetable chain or fruit chain; information is not easy to be transmitted fast and accurately, resulting in information asymmetry (Wu, 2006).

In pork chain, the retailer is the closest link to the market and the consumer, while farmer is the closest to the breeding and producing process. Retailer has the most information about market, price, consumer etc. while the pig farmer has the most information about safety and quality of the breeds, pigs etc. From this aspect, the chain actors have the motivation and demand to exchange information. If they can establish a transparent, fluent and accurate chain information exchange system, the information asymmetry will be controlled into the lowest level and safety and quality of the product will be well guaranteed.

Based on a transparent, fluent and accurate chain information collection and exchange, a traceability system is in high need as it is a tool that contains the information of the whole chain which makes the products be traced from “farm to table” and “table to farm”. It is a system innovation that European food operators need to implement in their plants to comply with “European General Food Law” (EGFL, Regulation (EC) No 178/2002) (European Commission 2002). It can be defined in several ways depending on its purposes, such as regulation, food safety, supply chain management, marketing, etc. The EGFL defines traceability as “the ability to trace and follow a food, feed, food-producing animal or substance through all stages of production and distribution”. Traceability system is one of the important manners in exchanging information, especially in information of safety and quality.

Food traceability can be defined as necessary information to describe the production history of a food crop, and any subsequent transformations or processes that the crop might be subject to on its journey from the grower to the consumer's plate. Traceability is a tool for achieving a number of different objectives. According to Can-Trace (2004) it has to be acknowledged that traceability is part of the food business systems and thus has to be integrated with logistic processes, good manufacturing/agricultural practices (GAP) and food safety programs, such as Hazard Analysis Critical Control Points (HACCP).

Information technology is obviously needed to solve the problems of data collection, transmission and analysis within the industry, there must be a common and standardized means of communication, and available to all.

Generally speaking, there are two ways to trace the information of products, which are

"bottom up" and "top down" (CCIC[1]), "bottom up" means that to trace the products' information from raw material supplier to the Point of Sale (POS) in order to check the reasons that could raise safety and quality problems and to check the characteristics and origin of the products. "Top down" means that when the consumers encounter safety problems of the food in POS, they can trace back to the origin of the food and make sure where the problem exists, this is always used in the reclaim of the products (see figure 7.26).

Spain

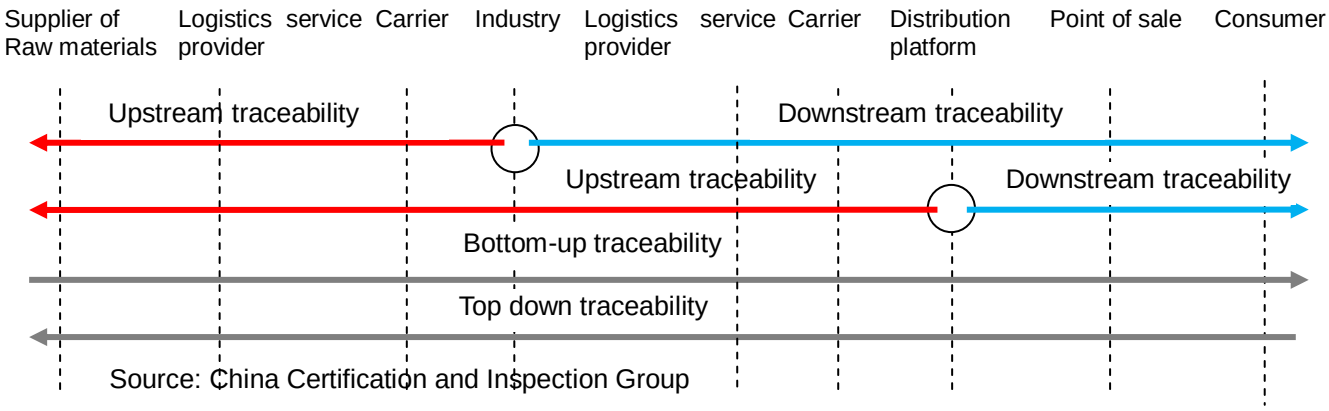
With regard to information use, generally speaking, each link of the pork chain in Spain has a lot of information related with its business. The breeders have the information about the breeds and reproductive indexes; the producers have the information of all the animals. Sows are numbered and every batch is identified in the software as it is known when it was born and from which sow, there is a calendar with the vaccination schedule. There is also a daily report in which it is reported the number of animals of each kind, where they are and what has been done. There is an established Data bank of Reference of the Spanish Pig System (BDporc) which is a service destined to the Spanish pig sector. It is promoted by the *Institut de Recerca i Teconologia Agroalimentàries* (IRTA), MARM and *Asociación National de Productores de Ganado Porcino* (ANPROGAPOR). One of its main objectives is to provide information of reference to the companies of pig production as tool of aid in the decision making. BDporc is open to any type of informatics system of management of the pig farms. It has available productive information from almost 600,000 sows belonging to more than 800 farms distributed for all the Spanish geography.

When animals move out of the farm, their movements have to be authorized according to the requirements of *Sistema Nacional de Identificación y Registro de los Movimientos de los Porcinos* (Identification and Registration of Swine Movement, SIMOPORC) system, which is a national database, in which all farms registered pigs in their territory and the movement of animals to or from them. When the animal arrives to the slaughterhouse, microbiological analyses should be done of every carcass in order to certify the safety of meat. Weights of carcasses are also known after the process for setting the prices. There are blood analyses done by a veterinarian on every pig in order to detect trichina. The systems used are both manual and automated. Retailers have the information from electronic labels; labels form the room of quartering about security and quality. Nearly all the links of the pork

[1] China Certification and Inspection Group

chain has automated software in order to contain information.

Figure 35. Traceability model



Source: China Certification and Inspection Group

With regard to information exchange, the breeder gives all the information that is related to the animal, date of birth, the weight when it is on the farm and the breed to the producer through leaflets, magazines and presentations, while the laboratory results of the animal are also included. The feed producer provides information about raw materials, composition of formula, batch of every raw material used and date of elaboration in order to be traceable. The information is transmitted through a consultant, labels, lectures etc. Producers provide the slaughterhouse type of carcass and final weight in order to guarantee traceability. Price is on the carcass, animals are paid in 90 days after delivering them based on the market of *Lleida*. The slaughterhouse exchanges the information to guarantee traceability and carcass quality with the processor, animals stay in the slaughterhouse less than 8-10 hours, after they have been slaughtered they stay 24 hours, price is settled depending on price of the market and carcass weight.

With regard to the traceability, as a member of the European Union, Spain implements the European General Food Law (EGFL, Regulation (EC) No 178/2002), it makes traceability compulsory for all food and feed businesses. It requires that all food and feed operators implement special traceability systems. They must be able to identify where their products have come and where they are going and to rapidly provide this information to the competent authorities. The EU has published guidelines which require business operators to document the names and addresses of the supplier and customer in each case, as well as the nature of the product and date of delivery. Operators are also encouraged to keep information on the volume or quantity of a product, the batch number if there is one, and a more detailed description of the

product, such as whether it is raw or processed.

In Spain, there is a quality certification done by CESFAC (Spanish Association of Concentrate Producers) called *Alimentación Animal Certificada*. It is a brand that guarantees traceability, origin of raw materials and safety in the processes. CESFAC is the non-profit professional organization that represents the interests of the Spanish compound feed industry (feed, premix and feed supplement) to National and International bodies and third parties. The 15 regional associations within CESFC assure adequate sector representation to regional public bodies. The Confederation is the only representative of the Spanish compound feed production to the European Feed Manufacturers Federation (FEFAC), Spanish Food & Drink Industry Federation (FIAB) and Spanish Inter-professional Organization of Animal Feed.

SIMOPORC is not only a data base to record information, but also has its function in tracing the movement of pigs among different farms, which extends to the entire territory of the Spanish State.

China

The information collection and exchange in China's pork chain, take the information exchange between the farmers and pig suppliers for example, the completeness, accuracy and timelessness of the information transfer is not efficient because the great numbers of pig farmers don't have a good educational level, technology and financial ability, they raise the pigs dispersal in the rural area, which makes it difficult to communicate with their chain cooperators in the chain. It leads to a lack of information of safety quality, raising the risks of having problems in safety and quality of the products.

With regard to the information exchange and collection between slaughter/processing industry and its upstream and downstream chain actors. Take Company A, one of the leading processing companies in China as an example, it provides the information about the products price, products' gross profits, service and safety of the products etc. to its important downstream retailers. Its important upstream suppliers provide company A the information about price, amount, feed, cost of pig raising and safety of the products, the focus of the information they exchanged is price and amount. Table 21 shows the accuracy, timelessness, completeness and amicability of the information exchange between company A and its upstream and downstream chain actors. We can see that the defects of information exchange between company A and its

upstream supplier are completeness and accuracy while the defects of information exchange between company A and its downstream retailer are timelessness and amicability.

From the perspective of the technology used in information exchange, company A has used internet, email and ERP system, which indicates that company A, as one of the most important meat processing industry in China, lays emphasis in exchanging information, while the efficiency needs to be improved. However, we have to admit that for the vast majority of the small household farmers and small butchers, they don't exchange information efficiently with their chain partners.

Table 21. Scores of information exchange between Company A and its chain partners

With upstream supplier	Score	With downstream retailer	Score
Accuracy	3	Accuracy	4
Timelessness	4	Timelessness	2
Completeness	2	Completeness	4
Amicability	4	Amicability	3

Explanations to the standard of score:
Accuracy: from precisely accurate, comparatively accurate, accurate, no so accurate to not accurate, the scores are 5, 4, 3, 2 and 1 respectively
Timelessness: from extremely timeless, very timeless, timeless, no so timeless and not timeless, the scores are 5, 4, 3, 2 and 1 respectively
Completeness: from extremely complete, very complete, complete, not so complete and not complete, the scores are from 5 to 1 respectively
Amicability: from extremely friendly, very friendly, friendly, not so friendly and not friendly, the scores are from 5 to 1 respectively
Source: investigated by the author

With regard to the traceability system, it is not so easy to be implemented in China for the following reasons:

1) most of the processing companies are small scaled with low level of information technology
2) the cost of establishing traceability system and doing certificates for traceable products too high to be afforded
3) Traceability is not easy to be conducted in the dispersed farmers with efficiency.

To be more specific, for the small household farmers, it is very difficult to conduct traceability as they are not able to afford the cost. Traceability is a systematic project

which collaborates with documents, standardized records and identifications and labels. Standardized information needs to be recorded properly with profession and necessary technology such as internet, which is not well accessed in the vast rural area in China. The ear tag is not used commonly in small household pig farmers, while it is used in specialized pig farmers and commercial pig farms.

On the other hand, in responding to much more concern about food safety in international market, AQSIQ promulgated GB/T20014.1－11－2005 called "Good Agricultural Practice national standard (China GAP)" in 2005. It is based on the control points and compliance criteria of Europe GAP (Europe Good Agricultural Practice), characterized on the Chinese agricultural growing and breeding standards, which is implemented on May 1st 2006. Till the end of 2009, there is only one company in pig meat industry has achieved China GAP. China GAP is highly encouraged in exporting companies in China. But generally speaking, traceability system is still not well-developed in China.

3.3.4 Logistic system in pork chain in China and Spain

Logistics is a process that plans, implements and controls the flow and stock of raw materials, semi-manufactured products and manufactured products from producing location to consuming location with high efficiency and low cost in order to meet the demand of consumers' demand. The logistic system in pork chain refers to the management of the flow of pork from origin to the end consumer of the chain.

The perishable agricultural products need to be preserved in cold conditions in order to keep their safety and quality during the whole process of the chain, which is known as cold chain, including the freezing process, frozen storage, refrigerated transport and refrigeration sales. As fresh pork is perishable product, it needs a good reservation from slaughter to POS to secure its safety and quality, including the freezing process after slaughtering, refrigerated transport, frozen storage and at last refrigeration sales and distribution.

Spain:

According to our survey, it is found that the logistics system in pork chain is provided by each link itself in Spain; Independent cold chain system is not widely used in the distribution.

From deboning room to their clients, such as *Mercas*, great distribution, traditional shops etc., the logistics are provided by deboning room. Logistics such as from *Mercas* to its clients is provided by each specific company of *Mercas*.

It is stated by the director of *Cárnicas Villa de Madrid,* S.L. that they would prefer to offer logistics themselves to their clients as they don´t trust the independent logistics companies in Spain, they need to supply the clients the products within 12 hours after the order while they don´t think the independent logistics companies could fulfil this task. And almost all the other meat wholesalers like this in *MercaMadrid* do the same, which means each of them has its own logistics.

It is also found that big meat industries, such as *Campofrio, Elpozo*, etc., as well utilize their own logistics to distribute their products in order to ensure safety of the products and efficiency of the delivery.

All the meat distributors have been obligated to pass HACCP from 2006 in Spain. The process of delivery is well controlled under cold condition to meet the requirements of HACCP.

It could be concluded that independent logistics system in meat industry is not popular in Spain. On the contrary, chain actors integrate logistics into their own business, which have given high cost to each link. The expert considers that if the independent logistics companies could provide good service, they would like to outsource their logistics service to this kind of companies in order to lower their own cost.

China

At present, big slaughterhouses have their own cold warehouse and refrigeration equipment to ensure the products be provided in the right temperatures in the process of production and preservation. The sales of terminal areas, as well, such as supermarkets, restaurants and hotels have the corresponding food refrigeration. However, problems exist:

First, many Chinese consumers have the traditional habits in consuming “hot fresh meat”, which means the pigs are slaughtered in the morning and are distributed to the market for the consumers without refrigerated transportation or frozen storage, the pork is not s stored in any cooling treatment, and the temperature changes according

to different seasons; the whole process from the pigs freshly slaughtered, to transport, wholesale and retail lasts about 4-5 hours. In this process, the hot fresh pork is inevitably polluted by the air, dust, flies, transportation vehicles, knife case, packaging material etc. During the whole process, bacteria are most likely to proliferate, which makes the consumption of this kind of meat is unsafe. (Ji et al., 2006).

With the recognition of knowing hot fresh pork is not safe, the consumers start to pay attention to chilled fresh pork, which means from the slaughtering, transportation to retailing the whole process, the pork is under cold condition with a temperature between 0 - 4 ℃. For this reason, big meat industries such as *Shuanghui* and *Yurun* etc. start to invest their own cold chain. *Shuanghui* began to put its chilled fresh pork into Beijing-market meat in 1996, and it is the first meat industry in China to introduce the "cold chain production and processing, freezing transportation, refrigerated sales" marketing model, which forms its unique competitive advantage (Liu, 2005). *Yurun* Group provides the consumers products quickly using their own cold chain, limiting the sales radius around 300-500 km to its processing industry.

However, the problem is, independent logistics companies are very few, which is underdeveloped. 90% of the meat in China is still not transported and distributed by cold chain (Zhang et al., 2006). As the meat industries are not specialized logistics companies, the cold chain infrastructure, equipment are not advanced.

Furthermore, there's still not a cold chain standard system in China. In 2007, Shanghai has passed the first cold chain management regulations in its own area, central government is making effort to form a standard since 2008.

3.3.5 Regulations, laws and quality management systems pork chain management in China and Spain

Regulations, laws and quality management system are important part of quality management of pork chain, which plays role of monitoring and supervising of the sector. An efficient regulation and quality management system is helpful for the guarantee of the pork safety.

Spain

The legislations and regulations system in Spanish pork chain is described in table 22 in terms of quality and safety, traceability, animal welfare and environment.

As a European country, Spain not only obeys the legislations and regulations of European Union, but also its national legislations and regulations settled according to its national situation.

From table 22 we can see that, in the case of feed producers, ISO 9000 and ISO 14000 are common accreditations. In the case of producers they have its quality controls inside the farm in terms of management practices. The management of the farm has increased quality of animals in recent years as animals are homogeneous and have better production indexes because of several reasons: the use of homogeneous reproductive animals, separation of animals in groups and improvement of installations. There is no accreditation in farms but the integrator manages quality of the farms of the associates.

Farms are also controlled by institutions. There are controls by the Regional Ministry of Agriculture in terms of number of animals, control of blood in the prevention of illnesses that can affect other farms and controls of the adequacy of the installation to the national regulations of welfare, well-being and safety.

HACCP implementation is obligatory for slaughterhouses.

In the case of retailers, great supermarkets have its quality programs and brands that guarantee their quality objectives. In the case of small retailers as the butcher interviewed, he comments they have the business according the regulations on safety and they have developed a code of good practices in the stores they have.

To detect the disease in livestock, which could cause serious economic, social and health loss and affect public health (e.g. zoonosis), Veterinary health warning system was created, whose legal basis by the Royal Decree 1440/2001, which consists of the following elements:

- The National Committee for Veterinary Health Warning System, Which coordinates activities between national authorities on animal health.

- The Rapid Intervention (SIR), consisting of veterinary staff with technical and

scientific knowledge needed to deal with emergency situations when there is a serious risk of epidemics or spread of zoonosis.

- A computer network that integrates health databases and whose name is Veterinary health warning network (RASVE) This computer system is an essential tool for the objectives pursued by the Veterinary health warning system. The RASVE integrates all health information available, both nationally and internationally, allowing real-time connection between the computer applications existing and Production Animal Health and Food Safety. This tool provides urgent decision making for prevention, control and eradication of animal diseases, while ensure a greater protection to public health.

We can see that the Spanish pork chain legislation system is clear and completed, which covers safety and quality, traceability, animal welfare and environment. In addition, the big companies have their private quality and safety systems to ensure the quality of their products.

	Quality and safety	Traceability	Animal health and animal welfare	Environment
The sector	RD 315/1996 sanitary conditions of production and marketing of fresh meat REG, 852/2004 Hygiene of food products REG 853/2004 Hygiene of products from animal origin REG 854/2004 Official control of animal origin products REG 2073/2005 Microbiological criteria	REG. 178/2002. General principles of food regulation where traceability is made obligatory EC No 178/2002	Agreements in the European Union	Ley 16/2002. Prevention and integrated control of pollution from the directive 96/61/CE
Breeder		RD 479/2004 General register of cattle farms. Identification systems and register of pigs (SIMOPORC)	RD 1201/2005 about protection of animals used for experimentation RD 1135/2002, minimal regulations for pig protection	RD 324/2000 for manure management
Feed producer	Framework normative. RD 418/1987, of 20 February, on substances and products involved in animal nutrition RD 2207/95 of the 28 December in which hygiene regulations on food products are established from the Directive 93/43/CEE,enterprises of the food sector must have self control activities based on the principles of the HACCP ISO 9001 and ISO14001:2004	REG 178/2002 regarding traceability		Ley 16/2002. Prevention and integrated control of pollution.
Pig producer	RD 1749/1998 Control of certain substances and wastes of live animals and its products RD 1323/2002 on which it is modified the RD 324/2000 3 march on which there are established basic regulations on pork farms. RD 142972003 of the 21 November in which there are regulated the application of the European regulations regarding sub products of animal origin not assigned for human consumption Reg. (CE) 1774/2002 of the European Parliament and Council of the 3 October 2002 on which sanitary regulations to be applied of animal sub products not used for animal consumption Control of swine fever	RD 479/2004 General register of cattle farms. Identification systems and register of pigs (SIMOPORC)	LEY 8/2003 of the 24 April of animal health RD 1135/2002, minimal regulations for pig protection RD 441/2001 of 27 April on which RD 348/2000 of 3 march is modified and it is added 98/58/CE regarding animal protection in farms	Law 16/2002 affects intensive pork production. For farms with more than 2000 places for pigs of more than 30kg and/or 750 places of sows There are regulation about: - Wastes to public beds - Agrarian manure application - Manure storage - Ammonia emissions - Special wastes - Noises
Veterinarian			RD 1440/2001 Creation of the veterinary sanitary alert system	
Transporter		ORDEN APA/3164/2002 National identification and register of pig movement system (SIMOPORC)	REG(CE) 1/2005 of the council of the 22 December 2004 protection of animals during transport RD 751/2006 of 16 June regarding authorization and register of transporters and means of animal transport	
Slaughterhouse	RD 2224/1993 sanitary regulations on transformation and elimination of death animals and animal wastes against pathogens in concentrates of animal precedence RD 3262/76 and others with the regulation technical and sanitary for slaughterhouses, rooms of quartering etc. Order of 16 January 1992 and others about classification of pig carcasses, methods etc RD 2207/95 of the 28 December in which hygiene regulations on food products are established from the Directive 93/43/CEE, enterprises of the food sector must have self-control activities based on the principles of the HACCP. ISO 9001 (2000)	RD 1808/1991 which regulates mentions that can identify a set	RD 54/1995, modified by RD 731/2007 about protection of animals during the slaughter process	
Processor	RD 1904/199 auto control system (HACCP) RD 202/2000 regulations for food handlers Orders related to stamps on skin of cured hams Regulations regarding the use of additives by the feed industry RD 1334/1999 and others. General regulation on labelling, presentation and advertising of food products RD 2207/95 of the 28 December in which hygiene regulations of food products are established from the Directive 93/43/CEE, enterprises of the food sector must have self control activities based on the principles of the HACCP	RD 1808/1991 which regulates mentions that can identify a set		
Retailer	RD 202/2000 regulations for food handlers RD 1376/2003 sanitary conditions of production, storage and marketing of fresh meat			

Table 22. Regulations and laws in quality management system in Spain Source: Sara Peña, 2008

China

The management departments of the government

At present, China has formed a management system coordinated by the State Food and Drug Administration (SFDA), jointly conducted by nine departments, which are Quality Supervision, Inspection and Quarantine (AQSIQ), Ministry of Agriculture, Ministry of Commerce, Ministry of Health, Ministry of Public Security, State Administration for Industry (SAIC), General Administration of Customs (GAC), State Environmental Protection Administration (SEPA). They are responsible for the governance and regulation of food safety and quality, including pork safety. Their functions in pork chain management are shown in table 23. SFDA is responsible for the coordination of all links of the chain, Ministry of Public Security is responsible for inspecting and enforcing of the law and regulations set. These two departments are responsible for the management and supervision for all the links of the chain; the other departments are responsible for each critical links of the chain.

Table 23. Administrative departments in China and their functions in pork chain

Departments	Raw materials			Pig production		Slaughtering and processing	Distribution of pork	Consumption of pork	Importing and exporting
	production	International trade	distribution	Location, environment	production				
SFDA	√	√	√	√	√	√	√	√	√
Ministry of Public Security	√	√	√	√	√	√	√	√	√
Ministry of Agriculture	√	√	√		√	√			
Ministry of commerce		√	√			√	√		√
Ministry of Health							√	√	
SAIC	√		√			√	√		
AQSIQ	√				√	√	√	√	√
GAC		√							√
SEPA	√			√		√			

Notes: The raw materials refer to the materials invested in pig production such as feed and veterinary drug

Source: from webpage of each department

There are problems exist in this management system, which are:

First, overlap of management right. To ensure the pork safety, the Chinese government has established a system that is composed with several departments. These nine departments manage coordinately, but their rights are not clearly defined and divided. Inevitably it causes the right of management overlap. They enforce the regulations according to each own standard, resulting the coordination difficulties. The overlap of the management right has caused low efficiency of this management system, while the pork safety accidents happen time and time again, which made the

consumers lose their confidence in pork safety. Some scholars describe this problem as “nine supervision departments are not able to well manage a plate of pork”.

Secondly, the current quality and safety management system pays inadequate concern in the origin links in pork chain such as feed production, pig production and pig/pork transportation. The related departments do not monitor efficiently the addictive of the feed and veterinarian drug.

Laws and regulations:

Laws and regulations in food safety and quality are basis of management and supervision, the laws and regulations related are listed in table 24.

Quality standard system

To continue to ensure and improve product quality, a lot of pork enterprises in China has got certification in quality standards, the main quality standards are as follows:

- ISO 9000 series of standards:

Though ISO9000 quality certification is becoming common, it is not obligatory, among the more than 2000 main meat enterprises, 57 have achieved ISO certification in 2005 (China meat association).

- GMP Standard:

GMP refers to Good Manufacturing Practice. It gives special focus on the implementation of automatic control of the production process on product quality and health safety. It is not obligatory, only several leading pork slaughtering and processing companies have got the certification.

- HACCP standard:

HACCP is the Hazard Analysis Critical Control Point which has got its recognition in FAO / WHO Codex Alimentations Commission (CAC) for its function in prevent and control the food safety.

Till 2005, there are 47 meat companies got HACCP. It is recommendable but not compulsory; many small meat industries do not have HACCP certification as they cannot afford the cost.

- QS Standard:

QS is the abbreviation of quality safety, it is a national market access system which is developed by the AQSIQ. It states the production requirements that the companies should meet to conduct production business and the requirements that the companies should meet to have their products sold in the market. QS includes three components, which are: (1) conduct a production licenses system to the food production enterprises; (2) conduct a mandatory testing to the finished products from the enterprises that are ready to sell; (3) sign the QS mark to the products that are proved to be qualified to have the access to market through the test, making the commitment to the public.

Table 24. National regulations and laws in pork chain in China

Actors of chain		National laws and regulations
Breeder	✓	Anti-epidemic law of P.R of China
Feed producer	✓	Feed and feed additives regulations
	✓	Standards of labels of feed
Pig producer	✓	Agri-products' safety and quality law of P.R of China
	✓	Animal Anti-epidemic law of P.R of China
	✓	Regulations on meeting emergencies of grave animal epidemics
Veterinarian	✓	Management of veterinarian
	✓	Animal Anti-epidemic law of P.R of China
Transportation	✓	Animal Anti-epidemic law of P.R of China
Slaughterhouse	✓	Agri-products' safety and quality law of P.R of China
	✓	Special regulations on strengthening supervision and management of the safety of food from the State Council
	✓	Food hygiene law of P.R of China
	✓	Management of slaughtering of pigs
	✓	Hygiene standard of pork (GB2707－1994)
Processor	✓	Agri-products' safety and quality law of P.R of China
	✓	Special regulations on strengthening supervision and management of the safety of food from the State Council
	✓	Food hygiene law of P.R of China
	✓	Hygiene standard of pork (GB2707－1994)
	✓	QS certification standard
Retailer	✓	Special regulations on strengthening supervision and management of the safety of food from the State Council
	✓	Agri-products' safety and quality law of P.R of China

Source: collected by the author

QS is a national standard of quality and safety, it is compulsory in China that all the producing and processing companies should pass to enter the market.

- Meat hygiene standards (GB2707-1994):

This standard specifies the meat hygiene requirements and testing methods for slaughtering pigs processed by the veterinary health inspection pass, allowing sales

of fresh pork and frozen pork. The standard is a quality inspection of meat products.

- Other quality standards:

Besides the systems and standards mentioned above, there are also other industrial standards, local standards and standards of each company, which are adopted to control and supervise the safe production.

3.4 Chapter summary

This chapter gives comparisons on pork chain and pork chain management between Spain and China. Many differences are found in respect to each link of the chain, governance of the structure, information use and exchange, logistics systems and quality management systems.

The main difference in pork industries between the two countries is the pig production manner. Small-scaled backyard pig production still dominates the pig production in China while big-scaled and commercial pig production is the main production way in Spain.

The main difference in pork chain management between the two countries is the governance structure. In China, spot market relationship dominates the governance structure though big processing industries are conducting new governance structures. In Spain, most of the chain agents choose cooperated or integrated governance structure to collaborate with their chain partners.

4. International pork chains analysis

The objective of this research is to identify the problems existing in the Spanish-Chinese export-import pork chain that hinder the movement of pork from Spain to China through a case study of the international chain, thus giving suggestions to the chain actors to improve their performance.

Supply chain management is not just a domestic phenomenon. It transcends national boundaries, imposing the challenges of globalization on managers who design supply chains for existing and new product lines (Meixell et al., 2005). However, experts maintain that global supply chains are more difficult to manage than domestic supply chains (Dornier et al., 1998; Wood et al., 2002; MacCarthy et al., 2003). The main difficulties include the substantial geographical distances, different local cultures, languages and practices that diminish the effectiveness of business processes. Variability and uncertainty of currency exchange rates, economic and political instability and changes in the regulatory environment increase the risk of the chain (Dornier et al., 1998) and affect the financial performance of the supply chain (Carter et al., 1988, 1989).

The traits of export and import of agricultural products in China keep growing at a fast rate. Till 2006, both the export and import amount of agricultural products have been increasing for 7 years (Ji, 2010). China opened its pork import market to Spain in 2007. With this background, we introduce the concept of the Spanish-Chinese Export-Import pork chain. An explorative study based on the interview of 22 Spanish meat companies and two experts from meat exporting promotion institutions is conducted. The study gives an example and evidence to international chain management studies. It identifies the main problems of the chain and generates conclusions accordingly, as a first step for the Spanish pork industries to develop market strategies.

Chapter 4

China keeps importing pork from United States, Canada and Brazil since 1990s (UNCOMTRADE, 2009). In 2007, General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China (AQSIQ) and MARM in Spain signed the agreement in trading pork. Since then, Spain got the legal right to export pork to Mainland China (MARM, 2008), and the products allowed to be exported are fresh pork (frozen), offal (feet, stomach and gut excluded) and cured pork products.

However, the amount of pork and is products that Spain exported to China was only 165,100 kg in 2008, which accounts for less than 0.04% of pork that China imported from the world (UNCOMTRADE, 2009). Furthermore, though the Spanish pork and its products have a good quality standard, only 19 pork companies have got their legal entrance to China (MARM, 2011). Up to now, the movement of pork through the Spanish-Chinese pork chain is not smooth and there must be difficulties existing in this international pork chain that hinder the movement of pork from Spanish producer to Chinese consumer.

Several main findings have been generated according to the interviews we have done, which will be described on the following section, giving attention to the structure of the chain, governance forms, information use and exchange, quality management and imported pork price issues.

The 22 Spanish meat companies were chosen randomly on the ¨Agricultural Products Fair Week--2010¨ in Barcelona, Spain. Another two experts from *Promotora d´Exportacions Catatanes SA* (Prodeca) and *Federació Catalana d´indústries de la Carn* (FECIC) are also interviewed. The basic information of the 22 companies is described in table 25.

More than 50% of the companies we interviewed are from Cataluña zone, where is the biggest pig production area in Spain. These companies dedicate in diverse businesses, including meat industries, meat processing and slaughterhouse and deboning houses. 95% of the companies showed their high willingness to export to China and five of them have got the authorities to export to China, which is half of the number of the total 11 companies in Spain who have got the permission. Four of these five companies are exporting offal as they said currently China has more interest in importing offal, two of them have got the right to export ham without bone and three of them are also exporting frozen pork. In the 17 companies which still have not got the

permission, 10 of them wish to export cured ham as they consider cured ham has more value-added, six of them would like to export offal as offal is one of their main products series and three of them would like to export fresh pork.

Table 25. Basic information of the 22 companies interviewed

Location	Murcia (2), Barcelona(4), Girona (4), Olot (2), Salamanca (2), Burgos (1), Valdepeñas (1), Toledo (1), Lugo (1), Teruel (1), Granada (1), Montesquiu (1), León (1)
Dedication	Meat industry (8), Meat processing (8), Slaughterhouse and deboning house (6)
Interest in exporting to China	Yes (21), No (1)
If it is exporting to China	Yes (5), No (17)
The products exported	Offal (4), Frozen Pork (2), Ham without bone (2)
The products wish to export	Cured ham (10), offal (6), fresh pork (3)

Source: Generated by the interview

4.1 Structure of the chain and actors implied

First of all, we define the chain structure (see figure 36 and figure 37). At the beginning phase of the trade between the two countries, the chain structures differ according to different types of products exported. The four companies that have got the authority export frozen pork and offal products through public or private importers, later the importers distribute the pork products to processing industries or supermarket or hypermarket. However, the two Spanish companies distribute cured pork products directly through Hotel and restaurants in China.

At present, most of the frozen pork and offal are imported through private importers in China. The Spanish meat industries contact these private importers with the help of *Instituto Español de Comercio Exterio* (ICEX) in Spain. The Chinese importers distribute the frozen pork and offal to the supermarket such as Carrefour. The cured pork products are distributed directly through Hotels and foreign restaurants in China, but the amount is very limited.

As this is an international chain, the role that third parties such as institutions or associations play is very important. It is positive that Spain and China now have good diplomatic relations. AQSIQ sends inspectors to visit Spanish companies in order to authorize them for exports. The same organism inspects the product on the boarders and also authorizes Chinese companies for imports. AQSIQ, the Chinese monitoring

institution, is in charge of trade food safety, standardization, certification and accreditation activities.

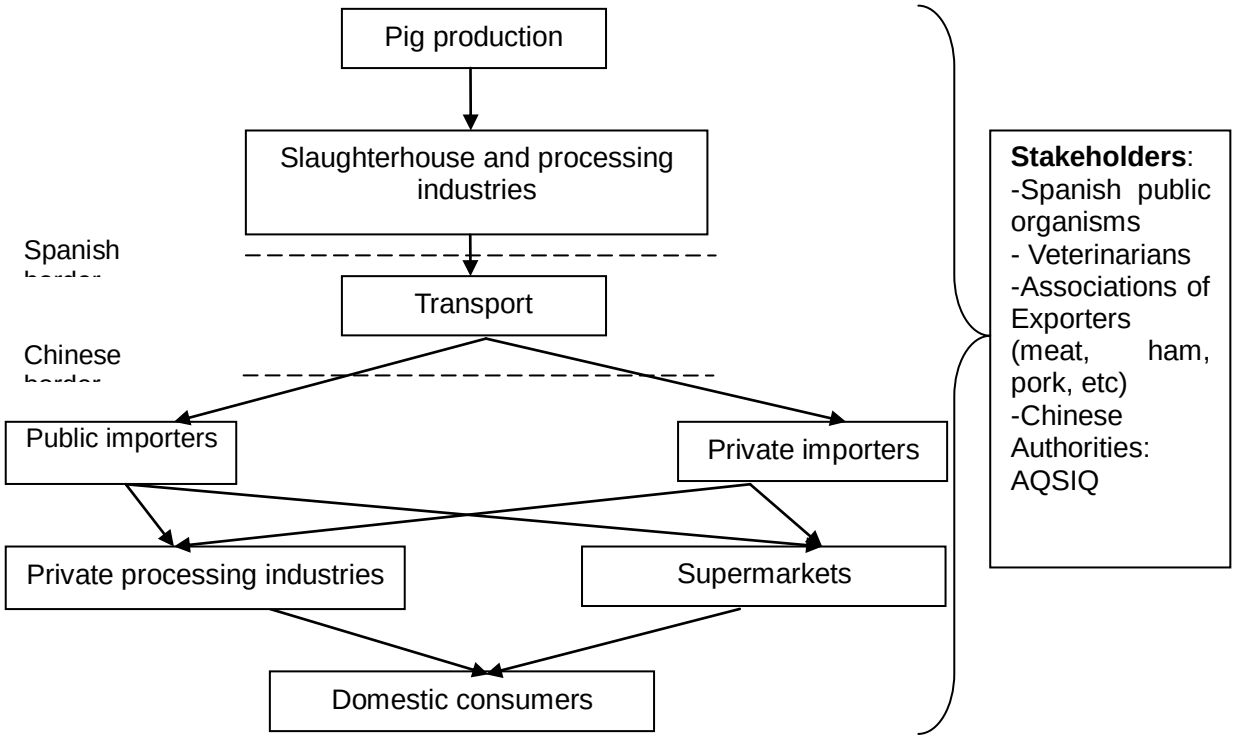
4.2 Governance of the chain

China and Spain have similar structures in the pork producing sector. Spot relations dominate the market, and just the big companies develop more integrated schemes. In Spain, it is mainly led by feed industries while in China big processing companies lead the integration.

In general, it can be said that the relation between actors in the Spanish part are long term because of the long history of the companies. The nature of the relation is formal, and it is made formal as there is a need to have transport guides because of track and tracing regulations in Europe with no exception of the kind of pork product or destination (European Parliament, 2002). The kind of contract applied is usually classical in the form of an invoice.

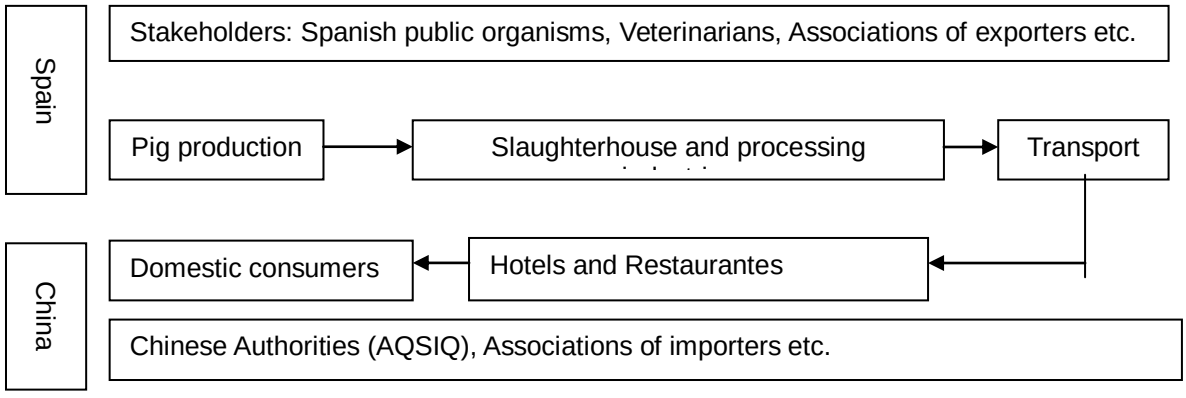
The relation between the Spanish meat industries and the importers in China is quite new which is now in a spot market position. The linking way between the Spanish companies and Chinese meat industries depends a lot on the company scale and their business content. As most of the Spanish meat companies are small and medium sized companies, 60% showed that if they could export to China, they will try to establish joint venture with the Chinese meat companies. Several big companies will choose to invest 100% privately funded companies in China. The slaughterhouses mainly choose to connect directly with the importers.

Figure 36. Structure of the Spanish-Chinese pork chain for frozen pork and offal



Source: drawn by the authors

Figure 37. Structure of Spanish-Chinese pork chain for cured pork products



Source: drawn by the author

However, at this beginning phase of trade, none of these four companies we interviewed has established Spanish-Chinese joint ventures in distributing their pork till now, which is one of the reasons why the movement of pork from Spain to China is still slow. Once there are Spanish-Chinese joint ventures established, the bilateral relationship will be long-term and the movement of pork will be smooth. The relationship between the meat industries and hotels and restaurants is also spot relationship, the meat industries provide the amount the hotel and restaurant require.

4.3 Information use and exchange along the chain

Easing and speeding the exchange of real-time information enables improvement of collaboration throughout the whole supply chain (Van der Vorst et al., 2002). A complete, timely and effective information use and exchange in the Spanish-Chinese pork chain influence the movement of pork products. Here we emphasize the safety and quality information and information about products and market.

Safety and quality information in the agri-chain is often transmitted through a traceability system, which refers to the "property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties" (Taverniers et al., 2004). In our case, the traceability of quality information is possible to be realized by labeling of the products. AQSIQ sets the following requirements: name of the product, product weight, name and address of a manufacturer, its registration number, storage conditions, and production date should be stated both in Chinese and English. The product name and registration number of the slaughterhouse / establishment should also appear on the packaging, making all of them traceable.

In the pork chain in Spain, the farm, slaughterhouse and processing industry are required to have a traceability system which is called *Sistema integral de trazabilidad animal* (integrated animal traceability system, SITRAN) composed by *Registro general de explotaciones ganaderas* (general register of the livestock farm, REGA) and *Registro de identificación individual de animales y movimientos* (individual animal identification and movement register, RIIA-REMO), where the information is registered and stored using information and communication technology (ICT).

Here, we notice that AQSIQ requires the information properly translated into Chinese. It happens frequently that Chinese consumers misunderstand how to eat the imported food product due to the incorrectly translated instructions of the labels into Chinese language (Yuan, 2005).

With regard to the information of products and market, we find that the companies who have got the permission, especially the companies who are exporting cured pork, have studied Chinese market. One of the companies has established a workshop to

prepare for the exporting to China. They studied Chinese market and Chinese consumers according to the studies done by Spanish embassy in China. On the other hand, some companies did not study the Chinese market and they had some misunderstandings about the consumers' eating habits of pork.

On the other hand, we find that the information of Spanish pork products is not exchanged to the Chinese market and consumers with efficiency, in other words, the Spanish meat industries still have not made enough effort to make their products well known in China. An expert in commercial affair views that the Spanish pork companies prefer to leave work after exporting to the Chinese distributors and concentrate in their production without many motivations in communicating with the Chinese consumers. Actually, as the Chinese consumers have a different habit of consuming pork, many consumers find exotic to consume ham directly like in Spain, the consuming habits are not well accepted in China.

4.4 Quality management systems

The Chinese government is paying more and more attention to safety and quality in the pork sector due to the frequently happened pork safety issues in recent 10 years in China. The newly happened Irish poisoned pork incident (China's quality affair news, 2008) in 2008 made AQSIQ tighten the monitoring of imported pork. To ensure the safety and quality of imported Spanish pork, AQSIQ has set a series of standards that farms, slaughterhouse, deboning industries, processing unities, packaging and labeling should meet and defined the responsibilities that the Spanish pork safety and quality monitoring institutions should take.

Spain pays attention to safety and quality of pork and its products. The Spanish pork feed producer and pig slaughterhouse implement the ISO 9000: 2000 system while HACCP is obligatory. SIMOPORC requires the registration of farms and movements of batches of pigs between farms (MARM, 2009). At the same time, Spain also has adopted the regulations and laws set by European Union, such as EC No.2160/2003 and RD 636/2006 to control the diseases of zoonotic and aujeszky. Furthermore, Spain has a system called *Red de Alerta Sanitaria Veterinaria* (Veterinary Health Alert Network, RASVE) which is a pioneer in the world (MARM, 2009). It combines all information and techniques of animal health in order to conduct an epidemiological warning. Thus, it facilitates the decision makers to prevent, control and eradicate the diseases.

However, although the Spanish meat industries show high interests in exporting their products to China, only 11 companies have got the permission. 90% of the companies we interviewed consider the biggest difficulty for them to export is the trade barriers set by China in the form of a high quality management standard that is hard to meet. To the Spanish farms, the Spanish side should officially confirm that the raising farm is free of diseases listed in table 26 in the first six months of raising pigs.

We find that the non-existence of diseases such as Contagious Pleuropneumonia, Porcine Transmissible Gastroenteritis, Trichinellosis, Porcine Reproductive and Respiratory Syndrome (PRRS) are required by the Chinese government while not by the European Union and Spain. The Chinese government sets standards considering its national situation, which is different from the standards of EU or Spain, making it more difficult for Spanish pork companies to get exporting permission.

In addition, a manager of export sector considers that the Chinese authority asked them for certifications whenever it thinks necessary without writing them down clearly in a document, which made it difficult for the meat industries to prepare and conduct the exportation.

Table 26. Disease control requirements set by China, EU and Spain

Pig diseases	Set by China[9]	European Union[10]	Spain[11]
Foot and Mouth Disease	X	X	X
Rinderpest	X	X	
Classical Swine Fever	X	X	
African Swine Fever	X	X	
Swine Vesicular Disease	X	X	
Teschen Disease	X		
Anthrax	X	X	
Swine Atrophic Rhinitis	X		
Brucellosis	X	X	
Leptospirosis	X		
Johne's disease	X	X	
Contagious Pleuropneumonia Porcine	X		
Transmissible Gastroenteritis	X		
Trichinellosis	X		
Porcine Reproductive and Respiratory Syndrome (PRRS)	X		
Tuberculosis	X	X	
Aujeszky's disease	X	X	X
Salmonella		X	X

Source: MARM; European Food Safety Authority (EFSA), 2009

[9] Pig diseases that should not exist in the pork exported to China from Spain
[10] European Union standards in controlling the pig diseases (as Spain is a member of European Union, the standards here are also adopted in Spain)
[11] Special national programs in Spain to control pig diseases

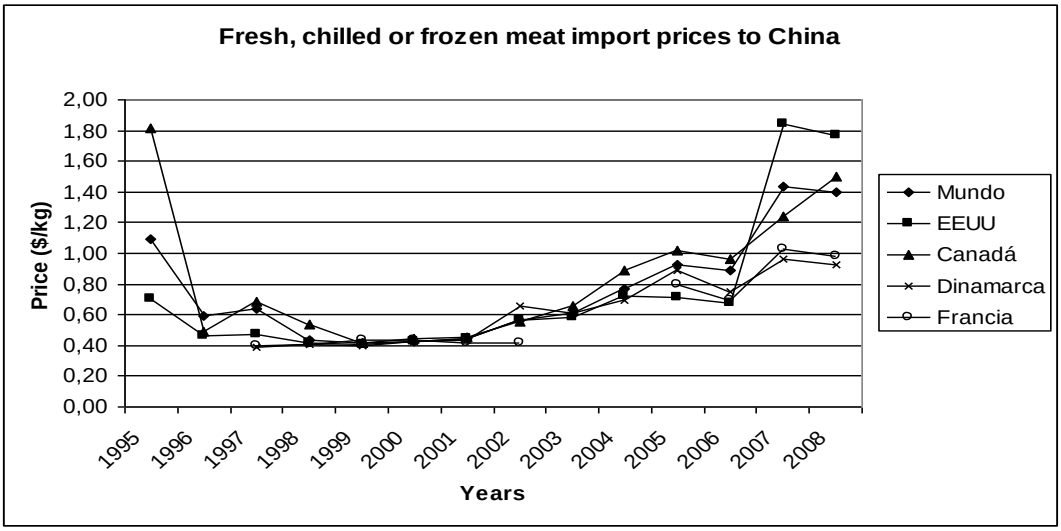
As stated above, the quality management control of China has formed a trade barrier between the two countries.

4.5 Imported pork price issues

In this part, we give a brief analysis of the imported pork price, which is closely related with value-added in the chain. It is given the average prices of pig meat and its products on the Chinese borders. There are three groups of products worth analyzing which are: meat (as fresh, chilled or frozen), edible offal and cured or processed pork products. Spain competes with countries such as USA, Canada, Denmark or France that have been exporting since the 1990s.

The companies consider that it is difficult for them to compete with the local producers in terms of the price of offal as the local offal is cheaper than imported ones. The Spanish companies have to decide the price of the products considering the price of other exporters, transportation cost and tariffs, which are shown in the figure 38, table 27 and table 28 respectively.

Figure 38. Disease control requirements set by China, EU and Spain



Source: UNCOMTRADE, 2009

China has captured the attention of many industries because of the possibility of exporting processed products, mainly cured and dry meats as one of the specialties in Spain. The exports in 2008 of hams were of 1,633 kg at an average price of 21.67 $/kg.

Table 27. Estimated sea transport charge from Spanish harbors to different harbors in China in air-conditioned containers (Euros)

Destination port	Shanghai		Huangpu (Guangzhou)		Xingang (Tian Jin)	
Transport days	23 days		24 days		24 days	
Type of container	20´	40´	20´	40´	20´	40´
Total Price (Euros)	3691.18	4040.15	3923.02	4427.02	3691.19	4039.15

Source: Illán, 2007

Table 28. Tariff barriers for pork products in China

Pork product	Characteristics	Generic tariff (%)	Most favorable nation (Spain among others) (%)
Meat	Fresh/chilled	70	20
	Frozen	70	12
Edible offals	Fresh/chilled	70	20
	Frozen	70	12
Livers	Fresh/chilled/frozen	70	20

Source: Euro-Lex, 2009

4.6 Chapter summary

This chapter gives an analysis on the international pork chain between Spain and China in order to find the difficulties in the pork trade between the two countries. It is found that problems in the governance of the chain, information exchange, quality management requirements and price issues impede pork trade. The results the analysis pointed out that Spain and China still do not establish a stable trade relationship. Therefore, the information exchange between the two parts is not enough. Through the comparison on the disease control requirements among China, Spain and EU, it is generated that China exerts a high-quality threshold on imported Spanish pork products. Furthermore, the price of imported Spanish pork products is not competitive compared with other pork exported countries to China.

5. Supply chain governance structure choice(s) research

5.1 Overview on governance structure and hypotheses generated

Chapter five establishes a whole framework of studying governance structure choices in supply chain through overviewing the theories, generating hypotheses, introducing a suitable method and conducting empirical research until finally giving conclusions.

5.1.1 Theories related with governance structure(s) in supply chains

The concept of governance structure is introduced by New Institutional Economics (NIE) (Williamson, 1975). Network governance is defined as the institutional matrix that encapsulates the configuration of multi-stage business arrangements within a given strategic network (Sauvée, 2002). Hesterley et al. (1990) defined that "a governance mechanism includes any institutional arrangement that serves to influence the exchange process." While Hendrikse (2003) also drawn that a governance structure consists of a collection of rules/institutions/constraints structuring the transactions between the various stakeholders. NIE studies are concentrated many aspects such as in modes of governance, enforcement mechanism, hierarchical structures, bargaining strength, etc.

Governance structure in supply chains is closely related with transaction activities among the chain agents and transaction cost economics, and NIE has been at the forefront of the development of issues of governance. They offer strategy as a set of normative rules for choosing among alternative governance arrangements (Masten, 1993), which lies in that organizing transactions involves costs (Ménard, 2001) and governance structure effects transaction cost economizing result (Williamson, 1998). Its "discriminating way" permits hypotheses about organizational form to be formulated and tested (Masten, 1993). However, several strands of viewpoints

criticized TCE in different aspects, mainly concentrating in theories, methodologies and empirical studies. Among them, the transaction value analysis (Zajac and Olsen, 1993) gives the logical insight from marketing strategy perspective, addressing that a sing-party cost minimization without analyzing the interdependence between exchange partners in the pursuit of joint value is not sufficient in governance choice studies.

These theories will be reviewed and discussed in the following part, based on which the logic base of the thesis will be summarized and stated.

5.1.1.1 Transnational cost theory and governance structure

The concept of transaction cost originates in Coase´s classic 1937 paper "The Nature of the Firm" and it was used to explain the nature and limits of firms. Transaction cost theory was reintroduced and developed by Williamson (1975, 1985), pointing out that "all cost differences between internal and market procurement ultimately rest on transaction cost considerations." Arrow (1969) considers transaction costs as "the costs of running the economic system." They may also be described as the costs of doing business and of friction in the economic system (e.g. Dietrich, 1994). Transaction costs are commonly contrasted with transformation costs, the costs of production and processing. A more focused view of transaction costs follows North (1990), who argues that information costs are the fundamental costs of transactions, and these may include the costs of stabling contract and relations with other parties, the costs of negotiation, the costs of exchanging rights to the commodities being transacted, and the costs of monitoring and enforcing the contract. These costs arise as a result of incomplete and asymmetric information, and are attempts to reduce risks that are endogenous to transactions.

Transaction Cost Economics is an important school within the New Institutional Economics, which has the potential to offer useful insights to agricultural economists working in a variety of fields in the food and agricultural industries in both developed and developing economies (Dorward, 1999). According to transaction cost economics, in a world without transaction costs all activities would be carried out as exchanges between units, and it is due to the failure of markets, or arenas of exchange, to allow for many exchanges without prohibitively high governance costs that organizations come to exist (Williamson, 1985, 1991). In other words, hierarchical organization is considered a response to market failure. Transaction cost economics is not only

concerned with the emergence of organizations per se to manage transaction costs, but also with how the choice of organizational form may vary according to the specific types of exchange activities encompassed.

TCE includes three assumptions that underlie decisions on given governance mechanism (Rindfleisch and Heide, 1997; Barney and Hesterly, 1999; Barzel, 2000; Masten, 2000; Dorward, 2001; Bijman, 2002; Leiblein, 2003), which are:

1) Bounded rationality. Bounded rationality refers to the limited capacity of humans to formulate and solve complex problems due to limited availability of information (Simon, 1957).

2) Opportunism. Williamson (1996) recognizes that people will behave opportunistically in business transactions and people will seek to serve their self-interest with guile which makes it difficult to know beforehand who is trustworthy and who is not.

3) Information is asymmetrically distributed. Thus people only have access to incomplete, imperfect or imbalanced information.

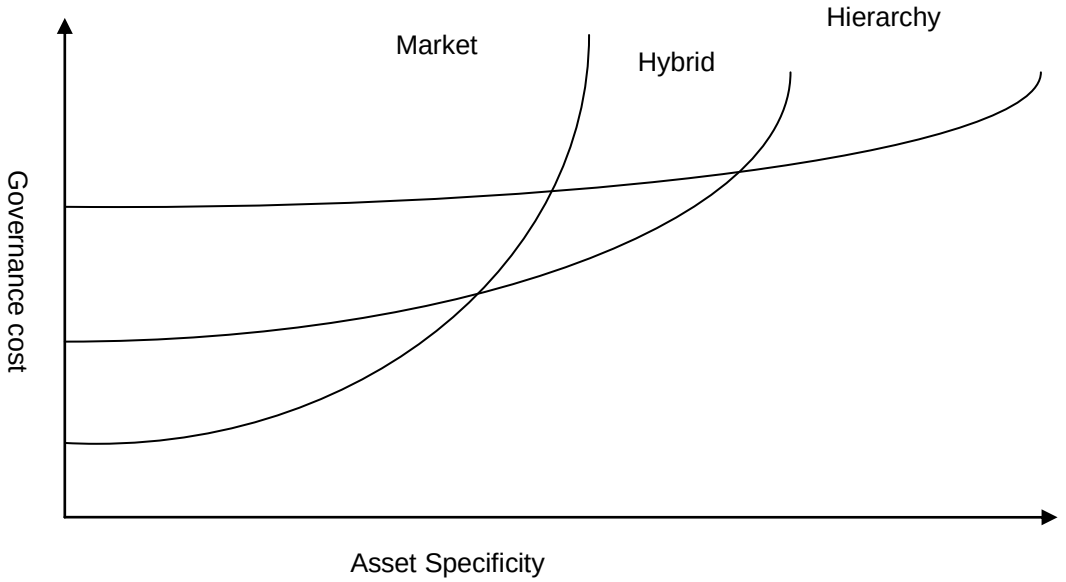
The three important assumptions suggest that it is costly to identify untrustworthy individuals' *ex-ante* (Williamson, 1996) and also indicate that all exchanges are costly. The theories put forth by Williamson (1975) and Klein et al. (1978) point out that transactions are seen to differ in terms of market contracting inefficiencies, which originate from small numbers bargaining situations. While small numbers bargaining situations may exist *ex-ante*. Therefore, TCE provides the insights that the governance of exchange agreements between economic actors is costly and governance forms vary in their ability to facilitate exchange depending on the attributes in the transactional environment (Leiblein, 2003).

The organization and governance of supply chains in agriculture are receiving increased research interest in mature market economics, and Transaction Cost Economics has been the dominant paradigm for analyzing issues in inter-firm relationships, channel structure, foreign market entry and so on. The central philosophy is that "governance structure aims at mitigating all forms of contractual hazards found between the partners in a transaction-cost economizing way" Williamson (1996). In the framework established by Coase and Williamson, the

organizational criterion is the minimization of production and transaction costs (Williamson, 1979). The choice of organizational governance form is seen as a central means through which management affects the costs of monitoring and administration or, more specifically, the costs of negotiating and writing contracts and monitoring and enforcing contractual performance (Williamson, 1975). Transaction cost theory proposes that if the transaction costs are low, economic actors will favor market governance. If these costs are high enough to exceed cost advantages of market, firms will favor contracting or internal organizations (Masten, 2000). In the case of strong collaboration, the buyer-supplier relationship is close to vertical integration, whereas lower levels of collaboration implicate spot market forms of collaboration (Claro, 2003).

Both Coase (1937) and Williamson (1979) examine factors affecting the organization of production systems in a market- hierarchy framework. In such a framework, the organizational criterion is the minimization of production and transaction costs (Williamson, 1979). Williamson (1985) developed a framework of three critical dimensions that determine the way governance should be structured in order to be most effective in bringing the firm's products to market. These are 1) the uncertainty associated with the transaction; 2) the degree to which specialized assets or investments are involved in the transaction; 3) the frequency of the transactions. Williamson (1991) proposed that transaction specific investments increase hybrid (e.g. short and long-term co-operations), and vertical integration mechanisms become the preferred governance as shown in figure 39.

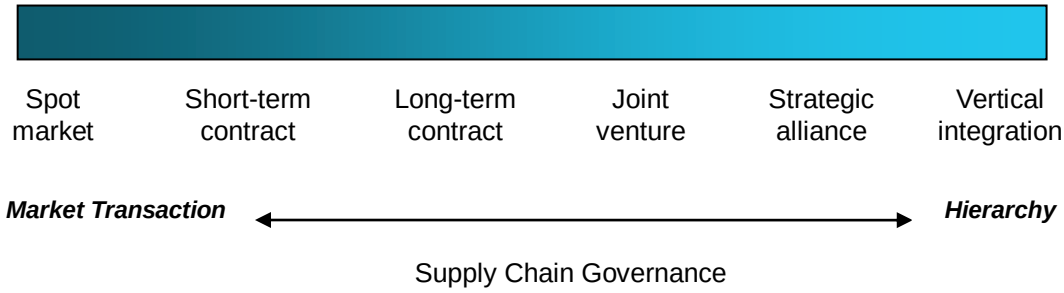
Figure 39. Governance difference within discrete structural forms



Source: Williamson, 1991

Within the SC, relationships may take on a variety of legal forms, including vertical integration, long-term contracts, and market transactions. Cooper and Ellram (1993) view SCM as lying between fully vertically, integrated systems and those in which each channel member operates completely independently (figure 40). Dierderen (2004) compared different governance structure forms with regard to their strengths, weaknesses and costs as shown in the following table 29.

Figure 40. Typology of supply chain governance structure



Source: adapted from Claro (2003) and Van der Vorst (2000)

Table 29. Mechanisms of governance structure forms, strengths, weaknesses, costs

	Market transaction	*Hierarchy*	*Social network*
Form	Spot market transactions, competition	Long-term contracts, sub-contracting, vertical integration	Strategic alliance, Joint ventures
Strengths	Information dissemination, incentives, specialization, experimentation, individual freedom	Enforcement, certainty	Motivation, commitment, information exchange, mutual learning, internal flexibility
Weaknesses	Rent seeking, commitment, profit distribution	Incentives, rent-seeking, individual freedom	Enforceability, free riding, abuse, external rigidity
Costs	Transaction costs: 1) searching 2) bargaining 3) enforcing	Agency costs: 1) monitoring 2) incentive alignment 3) bonding 4) dead-weight losses	Networking costs: 1) networking costs 2) cooperating 3) retaliating

Source: adapted from Dierderen (2004)

The advantages and disadvantages of vertical integration stated by Ellram (1991) are listed in the following table 30.

Table 30. Advantages and disadvantages of vertical integration

Advantages	Disadvantages
Improves control: • Reduction of uncertainty • Convergent expectations • Reduced probability of opportunism and externalities (e.g. dependency on monopoly suppliers) • Ease of conflict resolution	Limits competition: • More difficult for non-integrated firms to enter business • Weakens non-integrated competitors • Inability to replicate market incentives • Internal information distortion
Improves communication: • Improved co-ordination of processes • Greater goal congruence	Increase risk: • Asset concentration • Perpetuates obsolete processes • Exaggerates synergies
Improves cost structure • Economics of scale through avoidance of intermediaries • Process integration (improved asset utilization) • Avoids switching/transaction cost	Diseconomies of scale • Balancing scale economies • Inability of management to control large organization efficiently • Limits on span of control • Increased difficulty in communication

Source: Ellam, 1991

The vast majority of empirical literature in TCE has examined the factors which influence the choice of governance form. Coles and Hesterly (1998) pointed out that transaction cost – whether they stem from asset specificity, uncertainty or measurement difficulties – are central to understanding vertical integration, but the impact of these factors should not be examined in isolation.

Important empirical evidence provided by Shelanski and Klein (1995) supports the relationship between vertical integration and transaction cost, which involve the explanations of asset specificity and uncertainty. The studies in U.S. food industries from Frank and Henderson (1992) also supported that transaction costs are a primary motivation for vertically coordinating via nonmarket arrangements. The most influential transaction cost factors are related to uncertainty, input supplier concentration, asset specificity, and scale economics. Klein et al. (1990), Leblebici and Gerald (1981) suggested that environmental uncertainty undermines an organization's ability to predict future outcomes. Partners may act opportunistically when circumstances change, which may cause organizations to incur costs relating to communication, negotiation, and coordination (Klein et al., 1990; Rindfleisch and

Heide, 1997; Williamson, 1975, 1991). To economize on such transaction costs, organizations use an internal governance structure when environmental uncertainty is high (Klein et al., 1990; Williamson, 1985).

A similar logic can be applied to draw even finer distinctions about the type of contract used in those intermediate instances in which transaction cost considerations mandate alliances. The contract used for an alliance will be closer to either the market or the hierarchy extreme, depending on the magnitude of the transaction costs: the greater the transaction costs, the more hierarchical the contract (Pisano, 1989; Pisano et al., 1988). The possibility of opportunistic behavior by a partner generates the most salient transaction costs in the alliance context. Additional costs result from making alliance-specific investments, and from any uncertainty associated with the partnership itself.

Impersonal spot markets have evolved towards closer vertical coordination between stages in the chain. Traditional spot markets have obviously not been able to coordinate product quality efficiently in the face of shifting consumer demands, a greater diversity of products, more precise quality control and technological progress (Kennett et al., 1988). Information and knowledge are key factors promoting closer vertical coordination, as appropriate market institutions are a prediction for their transmission (Boehlje and Schrader, 1998).

Bargaining costs are direct costs of negotiating, documenting, and enforcing an agreement. It may also include the indirect costs of diminished efficiency caused by information distortions.

Transaction costs are both difficult to define and, once defined, difficult to observe and quantify (Dorward, 1999). Milgrom and Roberts (1990) cite coordination costs that arise because parties are unwilling to exchange accurate information about their preferences, which can lead to beneficial exchange opportunities being squandered.

In this context, the application of transaction cost economics to the formation of alliances is most apparent. Since alliances blend elements of the two extremes of market and hierarchy, it follows that firms would enter such arrangements when the transaction costs associated with an exchange are intermediate and not high enough to justify vertical integration (Bradach and Eccles, 1989; Eccles, 1981; Williamson, 1985).

5.1.1.2 Transaction value analysis and governance structure choices

Although TCE has become the dominant paradigm for analyzing issues in several areas of marketing, including inter-firm relationships, channel structure, foreign market entry, and so on (Ghosh and John, 1999), various strands of viewpoints criticized TCE in different aspects, which are reviewed as follows:

- The first criticism comes from strategy-oriented literature and Transaction Values Analysis (TVA). In this school, representative standpoints from Zajac and Olsen (1993) and Ghosh and John (1999) argue that TCE has made little headway into market strategy literature, emphasizing a sing-party cost minimization without analyzing the interdependence between exchange partners in the pursuit of joint value.
- Another point comments that studies from TCE are still static and structural, neglecting the fact that governance structure choice is actually a dynamic and process issue (Zajac and Olsen, 1993).
- The third remark stems from Resource Based View (RBV), which gives emphasis that firms unique resources influence governance structure. It posits that organizations insource when a resource is strategic to enable them to sustain competitive advantage (Barney, 1991; Mahoney and Pandian, 1992) and organizational form is determined by firms´ unique strengths and weaknesses (Leiblein, 2003).
- Finally, mainstream economists criticize the lack of mathematical models to support the reasoning and contribute to testable predictions, an implausible critique in light of the remarkable set of empirical tests and analysis already available in New Institutional Economics (Ménard, 2001). In the same paper, Ménard (2001) pointed out that there are two major weaknesses in the existing NIE theory, which are: 1) how we relate the analysis of transaction costs to the dynamic innovation; 2) interaction between institutional environments and governance structures.

Transaction Value Analysis (TVA) contends that TCE´s single-minded focus on cost minimization provides little insight into strategic marketing choices that are undertaken by exchange partners create and claim value (Zajac and Olsen, 1993). Webster (1992) notes that the (re)emergence of cooperation among firms is a “fundamental reshaping of the field marketing strategy.” Brandenburger and Nalebuff (1997) similarly observe that firms rarely create value in isolation, particularly in

advanced economies. Instead, they “align themselves with customers, suppliers and many others to develop new markets and expand existing ones.”

Zajac and Olsen (1993) pointed out that “while some might argue that transaction cost analysis does not neglect the issue of joint value inter-organizational strategies, but simply ‘holds it constant’, we suggest that even this interpretation may be problematic.” They propose that it may be more appropriate to hold transaction costs rather than transaction value constant if a factor must be held constant to focus on more critical factors. Based on this point, TVA proposes another focus in analyzing the inter-organizational strategy which is claiming the maximized joint value of the two (or multi) exchange partners.

They also emphasize the co-effect of transaction cost and transaction value on governance structure choice, addressing that “when the pursuit of transactional value necessitates higher transaction costs, and expected joint gains outweigh transaction cost considerations, inter-organizational strategies having a greater joint value will typically require the use of less efficient (from a transaction cost perspective) governance structures.” It could be understood from three aspects:

First, it strengthens that both transaction cost and transaction value is changeable variables; neither transaction cost nor transaction value is a constant. Second, it addresses the importance of transaction value´s effect on governance structure choice decision, the structure choice is not only decided by cost, but also by the joint value expected to be gained. Third, it emphasizes the co-effect of transaction cost and transaction value, compared with a matrix of low transaction and low joint value, exchanging partners may choose the structure matrix of high transaction and high joint value because the expected high joint value overwhelms the high transaction cost. While this structure is not efficient according to transaction cost economics due to its high transaction cost, but it´s chosen due to its overwhelming joint transaction value.

A central proposition that populates these theories is that when organizations invest in relation-specific assets, engage in knowledge exchange, and combine resources through governance mechanisms, a supernormal profit can be derived on the part of both exchange parties. The most recent theoretical term for this benefit is a ‘‘relational rent’’ (Dyer J, 1998). One of the most important performance outcomes expected from

improved inter-organizational relationships is cycle time reduction within the supply chain (Handfield et al., 1998, 2002).

“The transaction value, by examining the processes by which joint value is created and claimed, can encompass joint benefit and transaction cost issues in its framework. In recognizing 1) the interdependence of exchange partners seeking gain and 2) the relational context and processes of inter-organizational exchange over time, the approach offers a richer depiction of inter-organizational strategies than does standard transaction cost analysis. More generally, the approach seems well-suited to a view of inter-organizational strategies as voluntary, multi-firm collaborative efforts requiring a framework for analysis different from the transaction cost approach (which seems better suited for the study of an individual firm´s vertical integration- make or buy decision).”

However, the existed definition of transaction value in theories is neither clear nor concrete for an empirical study, expressed as the joint value that pursued by the exchange partners during their transaction. Through the overview of transaction value analysis, it is found that transaction value refers to joint improvements that achieved by exchange partners To make this concept clear and understandable, this study translates and explains transaction value as collaboration advantages:

Collaboration advantages refer to the joint advantages achieved through transaction (mutual activities) of agents in supply chains. These advantages form as mutual improvements in logistics systems, cash response, information exchange, technology and innovation and quality management.

It is noted that, like transaction cost differs from producing cost, collaboration advantages in this study do not include the firm profits drawn by the exchange partners jointly.

5.1.1.3 Resource Based View

In 1992, Mahoney and Pandian summarized how the Resource Based View (RBV) of the firm might be useful to the field of strategic management. And since then its strengths and weakness have been vigorously debated in strategic management and other management disciplines (e.g. Barney, 2001; Fahy and Smithee, 1999; Foss, 1998; Priem and Butler, 2001).

Several scholars have contributed to the development of the RBV (e.g. Barney, 1991; Dierickx and Cool, 1989; Wernerfelt, 1984). Many researchers, however, have focused on contributing to and extending Barney's (1991) conceptual framework (e.g. Litz, 1996; Powell, 1992; Rindova and Fombrun, 1999; Roy and Aubert, 2001), and some have used this framework to explain outsourcing decisions (Duncan, 1998; Prahalad and Hamel, 1990; Roy and Aubert, 2001; Teng et al., 1995).

The resource-based view argues that firms possess resources, a subset of which enables them to achieve a competitive advantage, and a further subset which leads to superior long-term performance (Barney, 1991; Grant, 1991; Penrose, 1959; Wernerfelt, 1984). Empirical studies of firm performance using the RBV have found differences not only between firms in the same industry (Hansen and Wernerfelt 1989), but also within the narrower confines of groups within industries (Cool and Schendel, 1988). This suggests that the effects of individual, firm-specific resources on performance can be significant (Mahoney and Pandian, 1992).

Resources that are valuable and rare and whose benefits can be appropriated by the owning (or controlling) firm provide it with a temporary competitive advantage. These resources allow an organization to conceive of or implement strategies that improve its efficiency and effectiveness (Barney, 1991). However valuable resources cannot give an organization a competitive advantage if many organizations possess them either when organizations can imitate the valuable, rare resources. Resources might be imperfectly imitable if they involve unique history, causal ambiguity, or social complexity (Barney, 1991; Dierickx and Cool, 1989; Lippman and Rumelt, 1982). Another organization must not be able to use alternative resources to implement the same strategies. That advantage can be sustained over longer time periods to the extent that the firm is able to protect against resource imitation, transfer, or substitution. In general, empirical studies using the theory have strongly supported the resource-based view (e.g. McGrath et al., 1995; Miller and Shamsie 1996).

The best strategy choice is the positioning option that is best matched to the resource position of the firm, the exchange attribute levels, and the governance forms deployed to manage its supply chain and end-customer exchanges (Ghosh and John, 1999). The resource of a firm includes technology resource, end consumer resource such as brand equity and market share.

Chapter 5

The resource-based approach focuses on the key success factors of individual firm behavior to achieve the firm-specific advantage by a portfolio of differential core skills and routines, coherence across skills, and unique proprietary know-how (Aharoni, 1993; Dosi et al., 1990; Prahalad and Hamel, 1990).

Mahoney and Pandian (1992) explained resource-based view within the conversation of strategic management. They addressed that RBV provides value-added theoretical propositions that are testable within the diversification strategy literature. Furthermore the resource-based view fits comfortably within the organizational economics paradigm. At the same time, resource-based view is complementary to industrial organization research. The resource-based view provides a framework for increasing dialogue between scholars from these important research areas within the conversation of strategic management.

Manhoney and Pandian arguably considered resource-based view as a fifth branch of the organizational economics tree of knowledge along with positive agency theory (Eisenhardt, 1989), property rights, transaction cost economics and evolutionary economics (Nelson and Winter, 1982). As well, the resource-based view not only simulates a conversation within mainstream strategy research, organizational economics and industrial organization research, but it also provides a framework for increased discussion between these research perspectives.

The resource-based view is linked to agency theory because the resource deployment of the firm is influenced by (minimizing) agency costs (Castanias and Helfat, 1991). The resource-based view is linked to property rights since delineated property rights make resources valuable, property rights become more precise (Libecap, 1989). Finally, the resource-based theory is linked to transaction cost theory because resource combinations are influenced by transaction cost economizing (Teece, 1982). The transaction cost, property rights and positive agency theory literatures provide the theoretical underpinnings for the resource-based approach by analyzing the nature of market failure (Mahoney and Pandian, 1992). Not only are there substantive areas of overlap between organizational economics and the resource-based view of the firm but there are methodological similarities as well. Fundamentally, the organizational economics paradigm of evolutionary economics, transaction cost theory, positive agency theory and property rights theory attempt to explain the origin, function, evolution and sustainability of our “institutions of capitalism” (Williamson, 1985).

The relationship between resource-based view and transaction cost theories, property rights theories and organizational economics indicate that resource-based view could be considered and applied into governance choice issues to complete the studies in this area.

5.1.1.4 Combined views from transaction cost theory, transaction value theory and resource based view

Though the overview of transaction cost theory, transaction value analysis and resource based view, it is found that the three theories are not contradictory. On the contrary, they could be complementary applied in governance structure in supply chain studies. The author proposes that the governance structure choice is the joint effect of transaction cost and collaborative advantages. Chain agents, as benefit-searching units, choose specific governance structure due to their considerations in reducing transaction cost and in achieving collaboration advantages. They intend to pursue joint advantages through a win-win transaction to implement their strategic management objects. Furthermore, joint advantages are related with the resource capability of chain agents, which help them to build competitive advantages in the chain. These propositions will be explained in the following part with regard to descriptions on hypotheses.

5.1.2 Hypotheses generated from theoretical reviews

From the theoretical overviews sated in section 4.1, seven hypotheses are generated, and they are explained as follows.

Based on the theoretical review of Transaction Cost Economics we stated in part 4.1.1, it is concluded that in selecting a governance mode, organizations attempt to minimize transaction costs. A market governance mode is preferred when transaction costs are low. Because of economies of scale and scope, TCT assumes that the market will always be the lowest-cost producer of a good or service. Alternatively, an internal governance mode is preferred when transaction costs are high. The production cost advantage of the market is overwhelmed by the high transaction costs incurred. Then we have the first hypothesis of this research, which is:

Hypothesis 1: Transaction cost has positive relationship with governance structure choice

It should be noted here that transaction cost itself is a negative value. The positive relationship between transaction cost and governance structure actually refers to the absolute value of transaction cost. When the absolute value transaction cost is expected high, the exchange partners tend to apply a more intense and stable governance structure to reduce the transaction cost.

Uncertainty refers to the unanticipated changes in circumstances surrounding a transaction. This uncertainty could preclude both the formulation of a contract ex-ante and/or the ability to verify compliance ex-post. The former (environmental uncertainty) can be reflected in constructs such as unpredictability of the environment, technology, and demand volume and variety. The latter (behavioral uncertainty) includes performance evaluation and information asymmetry problems. As discussed earlier, the effects of the bounded rationality constraint are accentuated by conditions of uncertainty (Grover and Malhotra, 2003).

The concept of uncertainty has long been a central component of a number of theories of organization and strategy. March and Simon (1958) identified uncertainty as a key variable in explaining organizational behavior. Thompson (1967) suggested that an organization's primary task is coping with the uncertain contingencies of the environment, especially those of the task environment. Pfeffer and Salancik's (1978) resource dependency theory suggests that organizations structure their external relationships in response to the uncertainty resulting from dependence on elements of the environment.

Uncertainty has two forms: behavioral uncertainty and environmental uncertainty (Rindfleisch and Heide, 1997; Simon, 1957; Slater and Spencer, 2000; Williamson, 1985). Behavioral uncertainty creates problems for performance evaluation. Exchange partners can use their own guile to create hidden costs by performing inefficiently and ineffectively (Rindfleisch and Heide, 1997; Williamson, 1985). Monitoring and enforcement costs must be increased (Williamson, 1975). Organizations attempting to minimize transaction costs that arise as a result of behavioral uncertainty are likely to choose an internal governance structure (Anderson, 1985; Gatignon and Anderson, 1988; John and Weitz, 1988; Williamson, 1985).

Environmental uncertainty undermines an organization's ability to predict future outcomes (Klein et al., 1990; Leblebici and Gerald, 1981). Thus, organizations have more difficulty in writing market contracts that cover changed circumstances. As a result, partners may act opportunistically when circumstances change, which may cause organizations to incur costs relating to communication, negotiation, and coordination (Klein et al., 1990; Rindfleisch and Heide, 1997; Williamson, 1975, 1991). To economize on such transaction costs, organizations use an internal governance structure when environmental uncertainty is high (Klein et al., 1990; Williamson, 1985).

Therefore, behavioral uncertainty and environmental uncertainty are introduced into the measurement of the variable of uncertainty in this study, and we conclude the second hypothesis which is:

> *Hypothesis 2: Uncertainty has positive relationship with transaction cost; higher uncertainty exerts high transaction cost*

Asset specificity refers to the transferability of assets that support a given transaction. A 'specific' asset is significantly more valuable in a particular exchange than in an alternative exchange and leads to a 'lock-in' effect that causes hold-up problems (Barney, 1999; Williamson, 1975). Highly asset-specific investments (also called relationship-specific investments) represent costs that have little or no value outside the exchange relationship.

These costs are mainly in the form of human specificity (e.g. training of salespeople, specifically for a certain partner) or physical specificity (e.g. investment by a supplier in equipment, tools, jigs, and fixtures to cater to idiosyncratic needs of a manufacturer). Investments in information systems that primarily serve the needs of one unique customer and cannot be leveraged across other external parties would also be another form of asset-specific investment. Zaheer and Venkatraman (1994) suggest that using proprietary systems increases business process asset specificity. Inducement of IT into the relationship reconfigures the existing processes and creates procedural specificity (Mukhopadhyay and Kekre, 2002), whereby firms develop processes (with or without IT, JIT etc.) that are unique to the relationship and which may require learning time if developed with other suppliers. Organizations attempt to protect against hold-up problems by using an internal governance structure

(Rindfleisch and Heide, 1997; Walker and Weber, 1984; Williamson, 1975, 1979, 1994).

On the other hand, transactions not supported by high-specificity assets are not prone to hold-up problems. Hence, organizations opt for the least-costly governance mode available in the market (Barney, 1999; Williamson, 1975, 1979, 1985a, 1994). Therefore, we generate the third hypothesis:

> *Hypothesis 3: The relationship between asset specificity and transaction cost is positive*

Based on the transaction value theories we stated in part 4.1.2, we generate the fourth hypothesis:

> *Hypothesis 4: collaboration advantages and governance structure choice have positive relationship*

When the expected transaction value is high, exchanging partners tend to apply more intense and stable governance structure to maintain or to increase transaction value. How to measure collaboration advantages will be explained in the section 5.2.3.

The creation and claim of joint value depends on two factors as it is extracted from the transaction value and resource based view which are willingness to collaborate and capability to collaborate. Zajac and Olsen (1993) put the importance on the both exchange partners´ concern for maximizing collaboration advantages. This concern is explained as "(1) knowing the partner´s preference and concern as a basis for exchange and mutual gain and (2) discovering ways in which similarities or shared interests can be exploited to maximize co-operative joint gains that accrue to both parties." Therefore, we define this concern to know each other and cooperate with each other as willingness to collaborate, and it is one of the factors that affect the claim of collaboration advantages, the higher the willingness they have, the collaboration advantages are expected higher. Therefore, hypothesis 5 is generated as follows:

> *Hypothesis 5: Willingness to collaborate has positive relationship with collaboration advantages*

The resource-based view (RBV) asserts that firms gain and sustain competitive advantages by developing valuable resources and capabilities (Barney, 1991). Firms internalize and maintain internally those activities in which their superior capabilities enable efficient production (Poppo and Zenger, 1998).

Research of Hsiao et al. (2009) gives insight of the concept of capability in this study. It is stated in their points on logistical resources, where logistical resources include tangible assets (such as trucks or warehouses) and intangible assets (such as knowledge or skills, i.e. 'capability'). Olavarrieta and Ellinger (1997) defined capability as a complex bundle of individual skills and accumulated knowledge exercised through an organizational process that enables firms to co-ordinate activities and makes use of their resources. They proposed that a logistics activity is executed or translated by an employee's capabilities and the most important is that the available capabilities also influence the make-or-buy decision. For instance, Argyres (1996) proposed that firms vertically integrate into those activities in which they have greater production experience and/or organizational skills (capabilities) than potential suppliers, and outsource activities in which they have inferior capabilities. They assert that firms internalize a certain logistics activity in which they have superior capabilities to gain value for themselves.

Therefore, capability to collaborate of the chain partners in this study is defined as the skills and knowledge that enable chain agents to collaborate and make use of resources. The capability of cooperate is not only logistics, but also technology, capital and intangible capabilities such as reputation, public appeal, etc. It is the capability or power of exchange partners to create and claim values. Each chain agent has its unique capability to collaborate and this capability influences the joint value gained and thus it influences make-or-buy decision. As a result, exchange partners who have a great "capability" will help two parts to achieve more joint competitive advantages and thus claim more joint collaboration advantages. Therefore, the sixth hypothesis is generated as follows:

> *Hypothesis 6: Capability to collaborate has positive relationship with collaboration advantages*

Finally, it is proposed that the uncertainty of environment will affect the joint value gained from both exchange parts, and the last hypothesis is sated as:

Hypothesis 7: Uncertainty has negative effect on collaboration advantages

With seven hypotheses generated, a suitable methodology is in need be applied to testify the hypotheses and thus to generate conclusions.

5.2 Methodology development

Methodology section will be developed by description of SEM method, conceptual model establishment, explanations and measurements of variables.

5.2.1 Description of Structural Equation Modeling (SEM)

1. Introduction to SEM

Structural Equation Modeling (SEM) is a method to study the social and natural phenomena of statistical causality and to explore and test the causal relationship between the relevant variables. It is a collection of related techniques that share some common characteristics. Briefly, SEM requires that the researcher consider an underlying model that depends on some structural parameters and then uses the covariance of observed data to test hypotheses about those parameters. SEM developed around several different research disciplines, and currently represents the integration of two different statistical traditions: factor analysis and simultaneous equation modeling.

SEM's origins can be traced back to Spearman (1904) with the development of what we now call exploratory factor analysis, but it was some years later when Wright (1921, 1934) developed and applied path analysis to the study of causal effects in the field of genetics. Later, the path analysis technique was spread to the fields of economics, sociology, and psychology. It was not until the early 1970s that path and factor analyses were integrated into a unique framework. However these main statistical methods in traditional research on the causal relationship between variables such as factor analysis, regression analysis and path analysis have many shortcomings. Factor analysis has two major flaws. The first is that as a compromise between multivariate statistical dimension reduction method, factor analysis´s main purpose is to synthesize a few factors from many variables through studying the internal dependent relationships of a phase matrix or covariance matrix, aiming to reproduce the original correlation between variables and factors; however, it could not analyze the causal relationship between the concepts of composition. Therefore, it is

only for us to further discuss the law of cause and effect relationship with some aspects of a combined value of the information, pointing out the further research direction. Second, factor analysis is not able to testify the hypothesis. Prior to analysis factor analysis, the nature of the data could not be clearly reflected, either the design of measurements of variables could be fully explicated. Furthermore, interpretations of the results are often constrained by the data itself, and it is difficult to express the theoretical design of the author. Some mathematical assumptions are not conducive to construction of theoretical models.

Regression analysis and path analysis are also statistical methods for recognizing the causal relationship. In regression analysis, although researchers may provide the dependent and independent variables to quantify the causal relationship between them, the causal relationship could not be proved entirely by regressions. In a regression model, even the causal relationship stated by the model between variables fit well the data; we are not able to assure that the causal relationship exists because if we exchange the dependent variable and independent variables, the relationship could also be fit well. Therefore, strictly speaking, regression analysis in the study is not conclusive evidence of the role of causal relationship, but a recognition that the dependent and independent variables of the relationship exist. Path analysis is an extension of regression analysis, but it is different from regression analysis as it overcomes one drawback of regression analysis, which is that regression analysis neglects time order between variables. It establishes the time order of variables according to the occurrence of events, and it adds the intermediate variable which is used to deduce the causal relationship among variables, actually path analysis could be considered as a matrix of several regression analyses. To sum up, regression analysis and path analysis only recognize that causal relationship does exist between variables, but they do not provide the evidence or explication how the causal relationship works.

Based on the shortcomings of the traditional methods, Jöreskog (1973) led in the hypothesis tests in factor analysis, which is called confirmatory factor analysis, and the traditional factor analysis is called exploratory factor analysis. He outlined the general structural equation model as the combination of two distinct parts: the measurement part that links observed variables to latent variables across a confirmatory factor model, and the structural part that describes the relationships among the different latent variables of the model. And since then (especially during the last two decades), we have witnessed a rapid expansion of the SEM techniques to

more diverse areas such as genetic behavior, education research, marketing, management, and psychiatry.

2. Characteristics of SEM

SEM is introduced aimed to solve the imperfections of traditional statistical methods, considering to improve the discussions on structures of variables and to establish relationships among variables, especially causal relationships, which is technically difficult for traditional methods.

SEM is a member of what is known as the general linear model. More standard statistical techniques such as regression analysis, simultaneous equations, factor analysis, or ANOVA can be contemplated as special cases of SEM. One must notice, nevertheless, that some flexible extensions of the basic SEM exist that allow the incorporation of some nonlinear relations.

The researcher needs to have some basic model in mind before using SEM. However, SEM analysis is not just a confirmatory analysis. A model can be as simple as stating which variables are assumed to affect others and the direction of such effects. The model can be then tested with SEM and might or might not be supported by the data. In the last case, the technique can guide the researcher towards useful and meaningful modifications of the initial model to improve its appropriateness without sacrificing its theoretical foundations. SEM can discern between observed and latent variables, which certainly widens the type of models that can be studied. For instance, abstract concepts such as “level of integration” or “quality of information” can be represented as latent variables (or factors) in SEM. It is then of course necessary to create accurate measurements of these factors. Issues concerning measurement errors in variables are thus easily distributed within the framework of SEM. Bollen (1989) and Lomax (1986) offer a discussion about the effects of measurement error in SEM. Many standard analysis techniques are based on the modeling of individual observations. For instance, a residual analysis looks at the differences between observed and fitted values for every observation in the sample.

SEM on the other hand considers and models all the sample observations simultaneously. Consequently, it attempts to minimize the function of the difference between the sample covariance and the predicted (by the model) covariance. The technique attempts to understand the correlations among a set of variables and tries to explain as much of their variance as possible with the model specified by the

researcher. However, it can also handle other types of analysis, such as analysis of means including between-group and within-group mean comparisons.

Compared with classical statistical methods, SEM has four advantages, which are: (1) The introduction of latent variables makes research go further. Although traditional factor analysis also allows the establishment of multi-identification of latent variables, it is not able to analyze relationships among latent variables; while SEM can identify and analyze various latent variables in the same model and to study their structural relationship.

(2) Similar with multiple regression analysis and path analysis, SEM also uses simultaneous equations to get solutions, but multiple regression or path analysis can only deal with variables with observed values, and it should be assumed that observed value does not present measurement errors. Meanwhile, SEM does not have strict limited conditions to the hypotheses, and it allows the dependent and independent variables have measurement errors.

(3) SEM develops of the advantages of path analysis; its path's map makes the comprehensive relationship among variables clearly understandable. On the other hand, path analysis adopts the standardized OLS (Least Squares) to estimate each equation separately, while SEM uses of the ML (maximum likelihood) model to estimate all parameters in the model simultaneously. Considering the relationship among all the variables at the same time is a good way to remove the effects of other factors and to estimate the causal relationship between two variables. SEM could not only calculate the direct relationship between variables, but also it calculates the indirect effect of intermediate variable. It also expresses the interaction and nonlinear relationships between variables by adding product terms and involution terms.

(4) SEM model incorporates regression analysis, path analysis, factor analysis, which makes it more broadly applicable.

3. SEM´s application in Supply Chain Management research

The field of Supply Chain Management (SCM) has seen rapid advances in recent years. However, how to conduct empirical research in this area has rarely been addressed. SEM is a statistical technique that combines measurement models (confirmatory factor analysis) and structural models (regression analysis) into a simultaneous statistical test (Byrne, 2001). An increasing number of SCM researchers

have recently employed SEM in their works. Some examples include Autry & Daugherty (2003); Gimenez and Ventura (2003, 2005); Stank et al. (2001) and Wisner (2003).

The SCM area involves abstract concepts such as integration, collaboration, coordination, competitive advantage and many others, which might be related among them. Such concepts can be represented by latent variables. Since the latent variables (also called factors) are not directly observable or measurable, it is necessary to have a set of measures (or indicators) to account for the abstract concepts of interest. The fact that SEM can analyze structural and measurement models simultaneously makes it especially valuable to researchers in SCM.

The usefulness of SEM lies in its ability to test hypotheses that are difficult if not impossible to evaluate with other analytical methods. This is since that SEM uses a very general framework that may encompass many standard statistical techniques. For example, combining factor analysis and structural equation modeling allows complex interrelated dependence relationships to be assessed, while simultaneously incorporating the presence of measurement error in the data. Another advantage of employing SEM is that there are currently many statistical software options that make SEM very easy to specify and estimate. Among the available programs, we can mention are AMOS, CALIS, EQS, LISCOMP, LISREL, MX, RAMONA and SEPATH. Some of these programs offer the possibility of "drawing" the model that one wants to estimate. The program then translates the drawing into code and performs an analysis. It is not necessary to say how appealing this is, although one must of course be very cautious in light of such automated alternatives.

4. Mathematical expressions of SEM

In many sociology, psychology, economics and management studies, some studies variables such as intelligence, social class, motivation, business performance, organizational effectiveness, which could not be measured directly and accurately, we are involved in the model which could not be directly observed variables called latent variables (Latent Variable), to respond to these latent variables, you must use some explicit indicators (Observable indicators), to reflect these potential variables. For example, the education level of parents of students, parents, occupation and income, as a student family socioeconomic status (latent variables) of the indicators, SEM is able to better respond to these explicit indicators of latent variables and relationships. Structural equation modeling can be divided into the measurement equation

(Measurement Equation) and structural equation (Structural Equation two parts. Measuring latent variables used to describe the main equations (Latent Variable) and explicit indicators (Observable indicators) relationship; and structural equation is used to describe a relationship between the latent variable which is the relationship between latent variable structural equations modeling focus of the study.

(1) the measurement equation (Measurement Equation)

The relationship between latent variables and indicators is usually written as the following measurement equation

$$x = \Lambda_x \xi + \delta$$
$$y = \Lambda_y \eta + \varepsilon$$

In this equation:

x : Vector made up of exogenous indexes, it is a $q \times 1$ vector consisting of exogenous indicators.

y : Vector made up of endogenous indexes, it is a is a $\mathrm{p} \times 1$ vector consisting of p exogenous indicators

ξ : Exogenous latent variable, it is a $\mathrm{n} \times 1$ vector made by the n exogenous latent variables

η : Endogenous latent variable, it is a $\mathrm{m} \times 1$ vector made by the m exogenous latent variables

Λ_x : relationship between exogenous indicators and exogenous indicators, it is the component matrix in exogenous latent variable of exogenous indicators, the $q \times \mathrm{n}$ component matrix of x on ξ.

Λ_y : relationship between endogenous indicators and endogenous indicators, it is the component matrix in endogenous latent variable of endogenous indicators, the $\mathrm{p} \times m$ component matrix of y on η

δ : error term of exogenous indicator x , it is a $q \times 1$ vector composed by q measurement errors.

ε : error term of endogenous indicator y , it is a $\mathrm{p} \times 1$ vector composed by p measurement errors.

(2) Structural Equation (Structural equation)

For the relationship between the latent variables, we use the following matrix equation (Bollen, 1989; Jöreskog and Sörbom, 1989).

$$\eta = \mathbf{B}\eta + \Gamma\xi + \zeta$$

Structural equation model defines the potential exogenous variables (ξ) and potential endogenous variable (η) between the linear causality.

η : Potential endogenous variable (the dependent variable potential)

ξ : Potential exogenous variables (potential independent variables)

B : Structure factor, refers to the potential causal relationship between the endogenous variables of the regression coefficient matrix

Γ : Structure factor, refers to the potential exogenous variables to explain the potential endogenous variable regression coefficient matrix

ζ : Potential residual endogenous variables

Structural equation modeling assumptions include:

（a）the measurement equation error term ε and δ with mean zero;

（b）structural equation residuals ζ with mean zero;

（c）among error term ε 、 δ , factors η 、 ξ are not related， ε and δ are not related;

（d）residual items ζ and ξ 、 ε 、 δ are not related

Besides the vectors Λ_x , Λ_y , B and Γ have been mentioned in the measurable equation and structural equation above, a complement structural equation also includes Φ , Ψ , Θ_ε and Θ_δ , Φ is the covariance matrix of ξ , Ψ is the covariance matrix of ζ , Θ_ε and Θ_δ are covariance matrix of ε and δ respectively.

To solve the vector $(p+q)\times 1$ and covariance matrix $(y',\ x')$, we can first solve the covariance matrix of y and x .

We propose that latent variable is centralized, so $\Phi = E\left(\xi\xi'\right)$, solve the $x=\Lambda_x\xi+\delta$ Covariance, we get

$$\Phi = E\left(\Lambda_x \xi + \delta\right)\left(\xi' \Lambda_x' + \delta'\right)$$
$$= \Lambda_x E\left(\xi\xi^{'}\right)\Lambda_x' + E\left(\delta\delta'\right)$$
$$= \Lambda_x \Phi \Lambda_x' + \Theta_\delta$$

So the covariance matrix of x is

$$\sum_{xx}(\theta) = \Lambda_x \Phi \Lambda_x' + \Theta_\delta$$

And the covariance matrix of y is

$$\sum_{yy}(\theta) = \Lambda_y E(\eta\eta')\Lambda_y' + \Theta_\varepsilon$$

Change the form of $\eta = \mathrm{B}\eta + \Gamma\xi + \zeta$ into

$$\eta = (I - \mathrm{B})^{-1}(\Gamma\xi + \zeta)\eta = \tilde{\mathrm{B}}(\Gamma\xi + \zeta)$$

In the equation above, $\tilde{\mathrm{B}} = (I - \mathrm{B})^{-1}$, and it is supposed that $(I - \mathrm{B})$ is a invertible matrix, we can get:

$$E(\eta\eta') = \tilde{\mathrm{B}}(\Gamma\Phi\Gamma' + \Psi)\tilde{\mathrm{B}}'$$
$$\sum_{yy}(\theta) = \Lambda_y E(\eta\eta')\Lambda_y' + \Theta_\varepsilon$$

And the covariance matrix of y and x is

$$\sum_{yx}(\theta) = E(yx')$$
$$= E\left[\left(\Lambda_y \eta + \varepsilon\right)\left(\xi' \Lambda_x' + \delta'\right)\right]$$
$$= \Lambda_y E(\eta\xi')\Lambda' = \Lambda_y \tilde{\mathrm{B}}\Gamma\Phi\Lambda_x'$$

5. Analytical steps of SEM

Applying Structural Equation Modeling to do research generally follows four steps.

(a) Model Construction

Building model framework and propose hypotheses according to the existed theory and previous research is the main purpose of this first step. By reviewing theories and related research, reorganizing the previous research findings as to the basis for establishments of hypotheses, conceptual model is constructed and these are important preparations for the next step. This step is extremely important for the whole model, and it is stated and explained in sections 4.2 and 4.3.1 in this research.

(b) Measurable variables design

Once the conceptual model is established, latent variables existed in the conceptual model need to be measured by suitable measurable variables. Design of measurable variables should follow two main principles; on one hand, the measurable variables should present very well the latent variables; on the other hand, the measurable variables should be easy to understand and should be measurable by good indicators. The choices of measurable variables and indicators could be based on the research existed or come from a practical need. With latent variables and measurable variables built, we will get a complete structural equation model. The step for this research will be stated in the following section 4.3.3.

(c) Questionnaire design and data collection

Continuously, based on the conceptual model and measurable variables, questionnaire will be designed and data should be collected. To ensure the rationality of questionnaires, the questionnaires should be examined through two steps:

I. Validity testing of the questionnaire content

Content validity refers to the appropriateness and representation of content in items title or item titles of sample measurement, meaning that content of the test should reflect the nature of the variable to be measured and should achieve the purpose of measurement as well be feasible. Content is often judged by reasonableness of the distribution subject. It is a logical analysis of propositions, which content validity is also known as "logical validity." In reality, many scholars utilize previous studies to design the questionnaire, reflecting the logical relationship between propositions, so if the proposition contained in a questionnaire from the previous studies have proven, we can consider that they have good content validity.

II. reliability test of the questionnaire

Reliability refers to the reliability and consistency of test results. Simply speaking, reliability refers to that if the measurement tools could stably measure the variables. The reliability of latent variables could be tested Crobach's α analysis.

(d) Model Checking

Based on the previous step, the data collected will be processed in software designed for SEM, such as Amos, Lisrel etc. and the models will be tested, which could be described as:

i. Model identification: this step decides if the model will give the only solution to the parameters;
ii. Model estimates: there are several different methods could be used to estimate model parameters, but the most commonly used methods are maximum likelihood methods and generalized least squares methods.

iii. Model Evaluation: After obtaining the parameter estimates, it is necessary to evaluate that if the model fits the data.

iv. Model improvement: If the model does not fit the data well, the model needs to be modified or improved by deleting, adding or modifying parameters of the model in order to make the model and data fit better.

(e) Interpretation and analysis of model results

According to previous test results, reasonable explanations should be given comparing the results with theoretical basis.

Considering the overview of SEM method, SEM methodology is a proper method in this study in that SEM is just specified in measuring and tracing relationships of conceptual variables that could not be measured directly. There are seven conceptual variables in this research needed to be studied as well as their relationships. SEM is good for exploring and explaining the relationships among all these variables. Model results will test the hypotheses raised in the research, based on which implications will be generated.

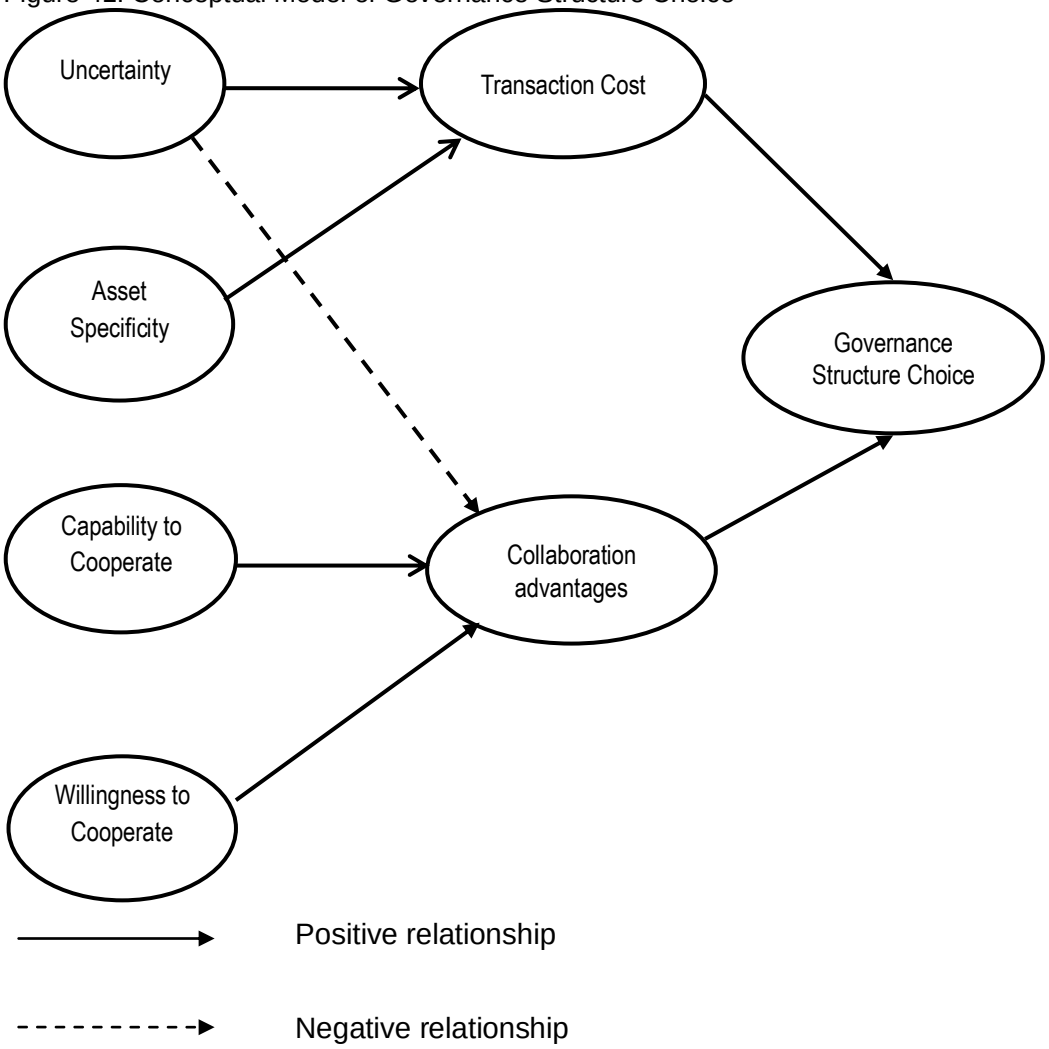
5.2.2 Conceptual Model

Based on the hypothesis raised above, the following conceptual model is established to trace the relationship among Transaction Cost, Collaboration advantages and Governance Structure Choice and the relationship among Uncertainty, Asset Specificity, Capability to collaborate, Willingness to collaborate, Transaction Cost and Collaboration advantages as well. The conceptual model is shown as follows in figure 41. The model is combined with seven variables and seven relationships (hypotheses). The solid arrow means the relationship between two variables is positive while the dashed arrow means the relationship between the two variables is negative, hypotheses, and conceptual model are sated as table 31 and figure 41.

Table 31. Hypotheses proposed in this research

Hypothesis code	Hypothesis content
H1	Transaction cost has positive relationship with governance structure choice
H2	Uncertainty has positive relationship with transaction cost
H3	The relationship between asset specificity and transaction cost is positive
H4	Collaboration advantages and governance structure choice have positive relationship
H5	Willingness to collaborate has positive relationship with collaboration advantages
H6	Capability to collaborate has positive relationship with collaboration advantages
H7	Uncertainty has negative effect on collaboration advantages

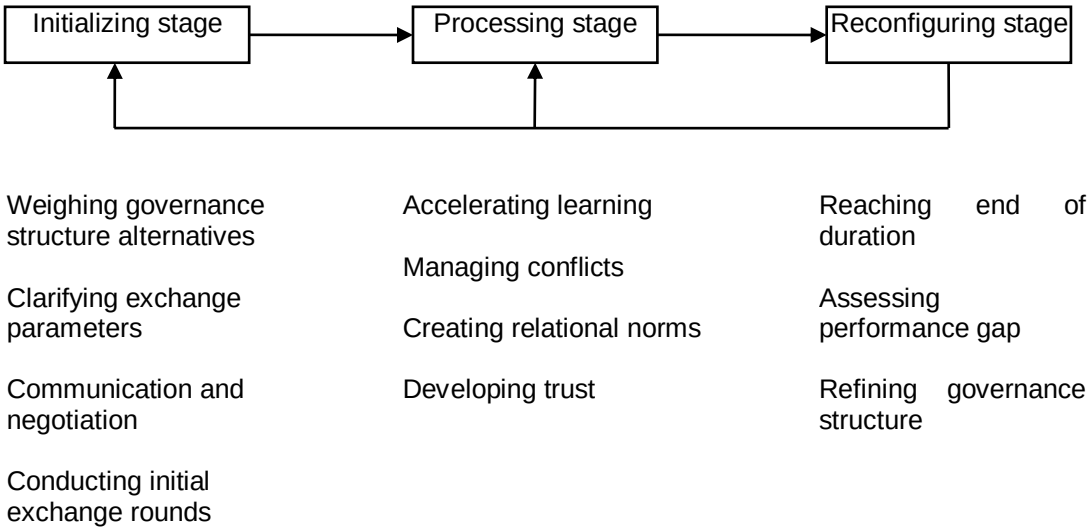
Figure 41. Conceptual Model of Governance Structure Choice



Before explaining the measurement of the variables, it is noted that this conceptual model on studying governance structure choice is a static link of the whole dynamic

choice process. In reality, the whole choice process is adjusting procedure, which could be divided into initializing stage, processing stage and reconfiguring stage (see figure 42). For example, chain agents process governance structure A, and they judge if the reduction of transaction cost and increase of collaboration advantages of governance structure A achieve their expectation, and they reconfigure the governance structure from A to B or they decide to continue applying governance structure A. This procedure goes round and round, and it is dynamic. However, to make this research clearer, only the process between initializing state and processing state is studied and explained.

Figure 42. Dynamic process of governance structure choice



5.2.3 Explanation and measurement to variables

In this part, how to measure the latent variables in the conceptual model will be explained as well as the measurable variables will be generated.

(1) Transaction cost

It has been decades since Ronald Coase wrote his now-famous article “The Nature of the Firm” (1937), in which he grappled with the nature of the firm within the context of the institutional structure of production. Departing from one of the fundamental tenets of neoclassical economics, he questioned the notion of frictionless markets and argued that there was a cost of using the price mechanism. The most obvious cost of “organizing” production through the market mechanism is that of discovering what the relevant prices are (Coase, 1937). These transaction costs make it more efficient to

organize an activity within the institution of the firm. Coase's main purpose was to explain why economic activity was organized within firms. It was not his purpose to predict which particular transactions would be organized within the firm.

Coase (1960) describes in his well-known article "The Problem of Social Cost" the transaction costs he is concerned with: In order to carry out a market transaction it is necessary to discover who it is that one wishes to deal with, to conduct negotiations leading up to a bargain, to draw up the contract, to undertake the inspection needed to make sure that the terms of the contract are being observed, and so on. More succinctly transaction costs are: search and information costs, bargaining and decision costs and policing and enforcement costs. This is the original scope of transaction cost and it is used in this research as the base to measure transaction cost.

Empirical work on direct measurement of transaction costs has been more nascent and limited, and has mostly been treated at the conceptual rather than at the measurement level. Pilling et al. (1994) categorized transaction costs associated with "*ex-ante* costs of developing and setting up an exchange relationship, and *ex-post* costs of monitoring performance, and dealing with opportunistic behavior (Rindfleisch and Heide, 1997).

Grover and Malhotra (2003) measured transaction cost by measuring the difficulty to associate with supplier, difficulty to monitor the performance of supplier, difficulty in addressing problems that might arise in the relationship with the supplier and the possibility of likelihood of the supplier taking advantage of its relationship with the firm interviewed. Dierderen (2004) listed the costs of market transaction, hierarchy and social network. Market transaction has costs of searching costs, bargaining costs, enforcing costs; hierarchy has costs of monitoring costs, incentive alignment costs, bonding costs and dead-weight losses; costs for social network are networking costs, cooperating and retaliating.

All these indicate that the measurement of transaction cost could be derived from its original concept, which means, transaction cost is able to be measured by the possible costs occurred in the transaction process between two exchange partners. Therefore, transaction cost in this study is reflected by five aspects, which are, searching cost, information cost, bargaining (negotiating) cost, contract making cost (decision cost) and monitoring cost. And these are the five factors used to measure

transaction cost. Table 32 shows the items applied to measure each of the five factors this is also the basis of design of the questionnaire.

Table 32. Measurement of transaction cost

Code	Content of items
Searching cost (SEC)	
1 (SEC 1)	It is very difficult to get information about pig industry
2 (SEC 2)	It is very difficult to find proper business partner (pig supplier)
Information cost (INC)	
1 (INC 1)	It is very difficult to know the information of your partner
2 (INC 2)	It is very difficult to exchange information with your partner
Bargaining cost (BAC)	
1 (BAC 1)	It is very difficult to get on an agreement with your partner
2 (BAC 2)	It is very difficult to agree on the conditions of the contract between you and you your partner
Decision cost (DEC)	
1 (DEC 1)	It is very difficult to decide to sign the contract with your partner
2 (DEC 2)	It costs a lot (time, capital, labor etc.) to finally sign the contract
Monitoring cost (MOC)	
1 (MOC 1)	It is very difficult to monitor your partner
2 (MOC 2)	If your partner betrays the contract, you suffer great loss

(2) Governance structure choice

The concept ¨governance structure¨ originates from the concept of ¨organizations¨ of the chain which refers the mechanism that chain members coordinate (Williamson, 1981). Later on, many scholars in institutional economics area develop this concept, for example, Hesterley et al. (1990) defined that “a governance mechanism includes any institutional arrangement that serves to influence the exchange process,” and Sauvée (2002) defined network governance is defined as the institutional matrix that encapsulates the configuration of multi-stage business arrangements within a given strategic network, etc., all which mean that governance structure is the institutional mechanism for the chain members to exchange with each other.

As it is stated in section 5.1.1.1, there are different typologies of governance structures, from spot market, short-term contract, long-term contract, joint venture to strategic alliance and vertical integration. Since the nature of governance structure is a matrix of transactions, this research tries to use the characteristics of transaction to measure governance structure, Zigger and Trienekens (1999) points out that when the structure of organization tends to be more intense and stable, the organization works more efficiently, especially when chain agents encounter emergency, an intense organization structure shows a better response. Williamson (1987, 2000)

considers that when companies invest more asset specificity and exchange more frequently, the opportunism will be reduced, and the structure is more intense. Therefore, no matter what typology of governance structure is, intensity and stability could be utilized to measure and reflect the intrinsic characteristics of governance structure(s). Measurements are described in the following table 33.

Table 33. Measurement of governance structure

Code	Content of items
Intensity of governance structure (IGS)	
1 (IGS 1)	Frequency of transaction between you and your cooperative partner is higher than that between you and a common chain agent
2 (IGS 2)	Your most important business only happens with your cooperative partner
Stability of governance structure (SGS)	
1 (SGS 1)	Both you and your cooperative partner rarely betray the contract
2 (SGS 2)	You and your cooperative partner have a long time cooperation
3 (SGS 3)	Either you or your cooperative partner gives up easily your cooperative relationship

(3) Uncertainty

Transaction costs are directly related to all the three independent constructs, asset specificity and uncertainty — both behavioral as well as environmental (Grover and Malhotra, 2003). Uncertainty refers to the unanticipated changes in circumstances surrounding a transaction. This uncertainty could preclude both the formulation of a contract ex-ante and/or the ability to verify compliance ex-post. The environmental uncertainty can be reflected in constructs such as unpredictability of the environment, technology, and demand volume and variety. The behavioral uncertainty includes performance evaluation and information asymmetry problems. Therefore, uncertainty is measured by two factors, which are environmental uncertainty and behavioral uncertainty (see table 34).

Table 34. Measurement of uncertainty

Code	Content of items
Environmental uncertainty (ENU)	
1 (ENU 1)	Regulations of the industry change frequently
2 (ENU 2)	Demand of the clients is not certain
3 (ENU 3)	Competition among the counterparts is fierce
4 (ENU 4)	Technology of the whole industry changes frequently
Behavioral uncertainty (BHU)	
1 (BHU 1)	Your cooperative partner and you do not exchange business information well
2 (BHU 2)	Your cooperative partner is not reliable
3 (BHU 3)	Trust between you and your partner is not established for a long time

(4) Asset specificity

Williamson (1985) identified site, physical, human and dedicated asset specificity as distinct types of transaction-specific investments. It has, by and large, been measured as a latent construct in the context of human asset specificity. Scales for other types of asset specificity such as physical asset specificity or brand name capital are less readily available due to the difficulty associated with their measurement and operationalization. Buvik (2002) operates asset specificity as: the magnitude of the investments and/or adaptations made by the buyer in physical assets, production facilities, tools and knowledge tailored to the relationships. The following table 35 established for measuring asset specificity draws lessons from studies of Anderson (1985), Heide and John (1990), Klein et al. (1989), and Sriram et al. (1992) among others.

Table 35. Measurement of asset specificity

Code	Content of items
Physical asset specificity (PAS)	
1 (PAS 1)	If you switch to other products, you will lose a lot of investments in facilities and tools
2 (PAS 2)	If you switch to other products, you will lose a lot of investments in human resources
Relationship asset specificity (RAS)	
1 (RAS 1)	If you switch to new suppliers, you will lose a lot of investments in time and efforts in establishing relationship with your former key supplier
2 (RAS 2)	You invest a lot of time and effort in maintaining collaborating relationship with your most important suppliers

(5) Collaboration advantages

The concept of collaboration advantages in this study originates from the transaction

value research of Zajac and Olsen (1993). Although it is not defined what is transaction value in their study, it is generated that transaction value/gains is expected joint gains that exchanging partners will get during the process of their transaction. The mutual benefits that the chain agents will get from their exchange process could be recognized and realized over time through enhanced information acquisition and exchange, along with the emergence of shared interests.

It is addressed that the key word of collaboration advantages is “joint.” Therefore, it comes from benefits created through all the mutual activities happened between chain agents such as logistics, cash response, information exchange, technological coordination, innovation cooperation and joint quality and safety improvement system establishment, etc. It concludes all interests that achieved jointly/mutually by exchange partners. Collaboration advantages are different as individual interests of each chain agent, though they are related; it is a collective concept like transaction cost. Simatupang et al. (2002) found that the joint interests will be created through coordination between chain agents through operational linkages and organizational linkages, and the mutual benefits lie on improvements in logistics synchronization, information sharing, incentive alignment and collective learning, in which collective learning implies collaborated technological benefits, innovative benefits, etc., which in line with the propositions mentioned in this section. Thus, “collaboration advantages” in this research is defined as:

“Collaboration advantages” is the joint value achieved through transaction (mutual activities) of agents in supply chains. This value forms as improvements, mainly in mutual logistics systems, cash response, information exchange, technological improvements and innovative improvements and quality management improvements, etc.

Empirical work on direct measurement of transaction costs has been more nascent and limited, collaboration advantages are going to be measured in this study according to the definition given, considering the quality and safety aspects of food chain, collaboration advantages are measured by six dimensions, which are logistics system, cash response, information exchange, technological exchange, innovative system and quality and safety management system (see table 36).

Table 36. Measurement of collaboration advantages

Code	Content of items
Logistics system advantages (LGA)	
1 (LGA 1)	Logistics between you and your partner will be well ensure the products supply
2 (LGA 2)	When emergency happens, logistics system will not be broken easily
Cash response advantages (CRA)	
1 (CRA 1)	Payment between you and you partner could be realized quickly
2 (CRA 2)	Cost of cash flow between you and your partner will be lower than that between you and other partners
Information use and exchange advantages (IEA)	
1 (IEA1)	You and your partner could share information about cost, price, products etc.
2 (IEA 2)	You and your partner could use the fastest and most convenient way to communicate
Technology advantages (TEA)	
1 (TEA 1)	You and your cooperative partner can adopt the new technology of the industry quickly
2 (TEA 2)	You know how to change and improve technology adjusting the demand of your partner
Innovation advantages (INA)	
1 (INA 1)	You and your cooperative partner can collaborate to co-innovation
2 (INA 2)	You and your cooperative partner can benefit from the co-innovation
Quality and safety management advantages (QMA)	
1 (QMA 1)	You and your partner collaborate to adopt good quality management practices in the industry quickly
2 (QMA 2)	You and your cooperative partner jointly to establish good practices to ensure food safety

(6) Willingness to collaborate

Willingness to collaborate is proposed as one of the factors that influence collaboration advantages, and it originates from the transaction value theories framework. Zajac and Olsen (1993) consider that the exchange partners´ willingness to know each other and their willingness to make the joint effort have effect on collaboration advantages. Thus, these two dimensions will be applied to measure willingness to collaborate variable (see table 37).

Table 37. Measurement of willingness to collaborate

Code	Content of items
Willingness to know the partner (WTK)	
1 (WTK 1)	You have great willingness to know your cooperative partner' s preference
2 (WTK 2)	You consider the mutual knowing as the basis of cooperation
2 Willingness to make joint effort (WTE)	
1 (WTE 1)	You have great willingness to discover similarities and common interests between you and your cooperative partner
2 (WTE 2)	You have great willingness to make great effort to maximize the joint value between you and your cooperative partner

(7) Capability to collaborate

On one hand, it is proposed that the exchange partners should have the willingness to collaborate; on the other hand, the chain agents need the capability to collaborate in order to create collaboration advantages.

The variable capability to collaborate comes from RBV theories. Researchers and practitioners interested in the RBV have used a variety of different terms to talk about a firm's resources, including competencies (Prahalad and Hamel, 1990), skills (Grant, 1991), strategic assets (Amit and Schoemaker, 1993), assets (Ross et al., 1996), and stocks (Capron and Hulland, 1999). This proliferation of definitions and classifications has been problematic for research using the RBV, as it is often unclear what researchers mean by key terminology (Priem and Butler, 2001). Wade and Hulland (2004) define resources as assets and capabilities that are available and useful in detecting and responding to market opportunities or threats (Sanchez et al., 1996; Christensen and Overdorf, 2000). Assets are defined as anything tangible or intangible the firm can use in its processes for creating, producing, and/or offering its products (goods or services) to a market, whereas capabilities are repeatable patterns of actions in the use of assets to create, produce, and/or offer products to a market (Sanchez et al., 1996). Assets can serve as inputs to a process, or as the outputs of a process (Srivastava et al., 1998; Teece et al., 1997). Assets can be either tangible (e.g., information systems' hardware, network infrastructure) or intangible (e.g., software patents, strong vendor relationships) (Itami and Roehl, 1987; Srivastava et al., 1998). In contrast, capabilities transform inputs into outputs of greater worth (Amit and Schoemaker, 1993; Capron and Hulland, 1999; Christensen and Overdorf, 2000;

Sanchez et al., 1996; Schoemaker and Amit, 1994). Capabilities can include skills, such as technical or managerial ability, or processes, such as systems development or integration.

With these references, in this study, capability to collaborate is considered as competitive tangible and intangible resources (capability) of the firm that could be utilized to realize the cooperation between chain agents aiming to maximize the joint gains. Tangible capability refers to the ability to offer goods and services such as capital, technology, logistics systems; intangible capability refers to the ability to transform inputs into outputs of greater worth such as business reputation, public appeal, and managerial skills. Thus, the measurement of capability to collaborate is stated as table 38.

Table 38. Measurement of capability to collaborate

Code	Content of items
Tangible capability to collaborate (TCC)	
1 (TCC 1)	Between you and your cooperative partner, at least one has great capital to enhance your collaboration
2 (TCC 2)	Between you and your cooperative partner, at least on holds key technology of the industry
3 (TCC 3)	Between you and your cooperative partner, at least one has strategic logistics systems
Intangible capability to collaborate (ITCC)	
1 (ITCC 1)	Between you and your cooperative partner, at least one has good business reputation
2 (ITCC 2)	Between you and your cooperative partner, at least one has good public appeal
3 (ITCC 3)	Between you and your cooperative partner, at least one has good relationship and managerial skills

Based on the description of the seven latent variables and their measurements above, the following table outlines all of them together.

Table 39. Latent variables and their corresponding measurable variables

Latent variables	Measurable variables
Transaction Cost	1. Searching Cost (SRC) 2. Information Cost (INC) 3. Bargaining Cost (BAC) 4. Decision making Cost (DEC) 5. Monitoring cost (MOC)
Governance Structure choice	1. Stability of the Governance Structure（SGS） 2. Intensity of the Governance Structure（IGS）
Uncertainty	1. Environmental Uncertainty (ENU) 2. Behavioral Uncertainty (BHU)
Asset Specificity	1. Physical asset specificity (PAS) 2. Relationship asset specificity (RAS)
Collaboration advantages	1. Logistics Advantages (LGA) 2. Cash Response Advantages (CRA) 3. Information Use and Exchange Advantages (IEA) 4. Technology Advantages (TEA) 5. Innovation Advantages (INA) 6. Quality Management Advantages (QMA)
Willingness to collaborate	1. Willingness to know the partner（WTK） 2. Willingness to make joint effort（WTE）
Capability to collaborate	1. Tangible capability to collaborate（TCC） 2. Intangible capability to collaborate（ITCC）

5.3 Empirical evidence

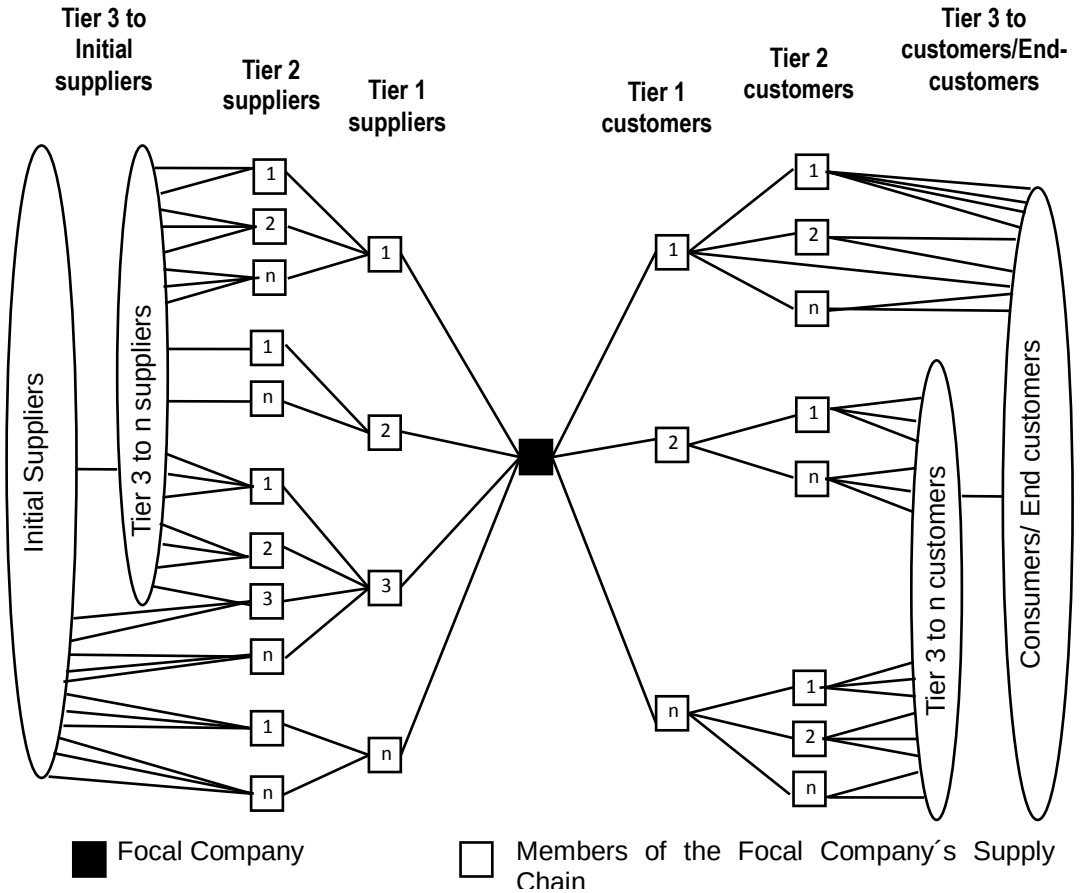
Empirical evidence will be given through data collection and questionnaires description, reliability analysis and SEM model establishment, model results and explanations.

5.3.1 Data collection

As it is stated in chapter 3, pork sector is the most important livestock sector in China. China´s pork chain is undergoing great changes in several aspects. Although the small scale (backyard) pig production still dominates the production way in China, specialized and commercial productions are getting their importance. The similar situation takes place in slaughtering and processing industry, big pork slaughtering and processing companies are actively underway to explore and advance on the governance structure development such as long-term contract, “company-cooperatives-pig farmers” and vertical integrations.

In supply chains, especially agri-food chains, there are focal companies, which interact directly or indirectly with upstream suppliers and downstream customers (Lambert and Cooper, 2000) (see figure 43). Usually, they are the ones in the chain who drive governance development with their upstream or downstream chain agents, and they are important value-added links in the chain. In China's pork chains, the slaughtering (slaughtering-processing) companies are focal agents of the chain as they are the main organizations that drive the chains´ governance structure development. The governance structure between the focal company and its connected company has influence on the governance structure of the chain. Although this part of governance structure could not represent governance structure of the whole chain, concentrated analysis on governance structure of this link could mostly reflect the situation of the chain. Therefore, this paper chooses the governance structure between slaughtering (slaughtering-processing) companies and their upstream chain agents (pig farmers) as the research object.

Figure 43. Network of a focal company supply chain



Source: Lambert and Cooper, 2000.

Chapter 5

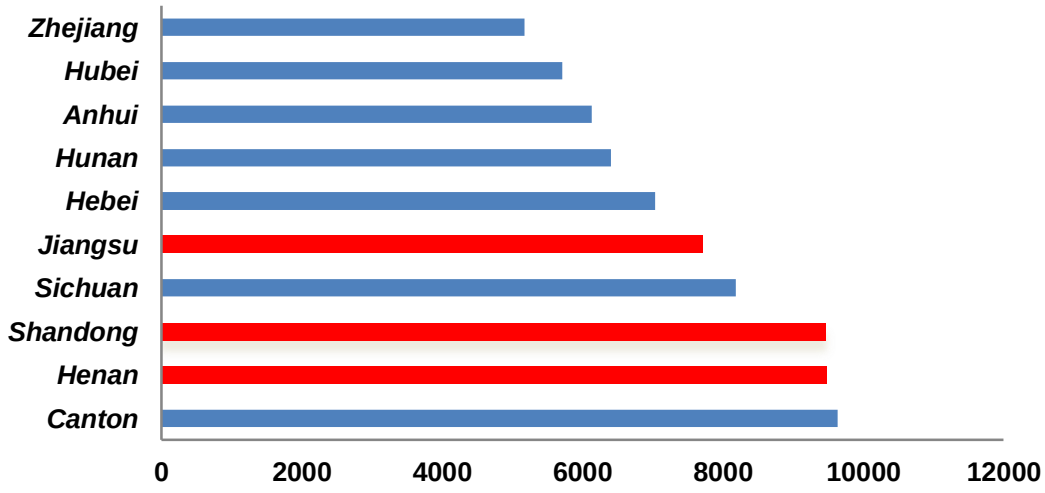
As sated above, the focal company of China´s pork chain, pork slaughtering (slaughtering and processing) companies will be the objects of interviews. Before conducting the formal investigation, trial interviews were initiated in September, 2010 by the author personally and her Chinese colleagues from Nanjing Agricultural University. Final questionnaires (see appendix 3) were revised according to the result of the trial interviews. Formal investigation was carried out during three months from October to December, 2010 by a group of doctorate students from Nanjing Agricultural University with the financial support and academic guide of their supervisor, Professor Wang Kai. A sample of 350 slaughtering (slaughtering-processing) companies in three big pig production and pork processing provinces, which are *Jiangsu* Province, *Henan* Province and *Shandong* Province (see figure 44). They are labeled in red, orange and blue color respectively.

Jiangsu, Henan and *Shandong* provinces locate in the east part of China, they have great population in China with 77.25 million, 94.87 million and 94.7 million persons respectively by the end of 2009 (see figure 45) and they are fast developing locations in that they create good economic results during the past 5 years (see figure 46).

Figure 44. Locations of *Jiangsu*, *Henan* and *Shandong* Provinces in China

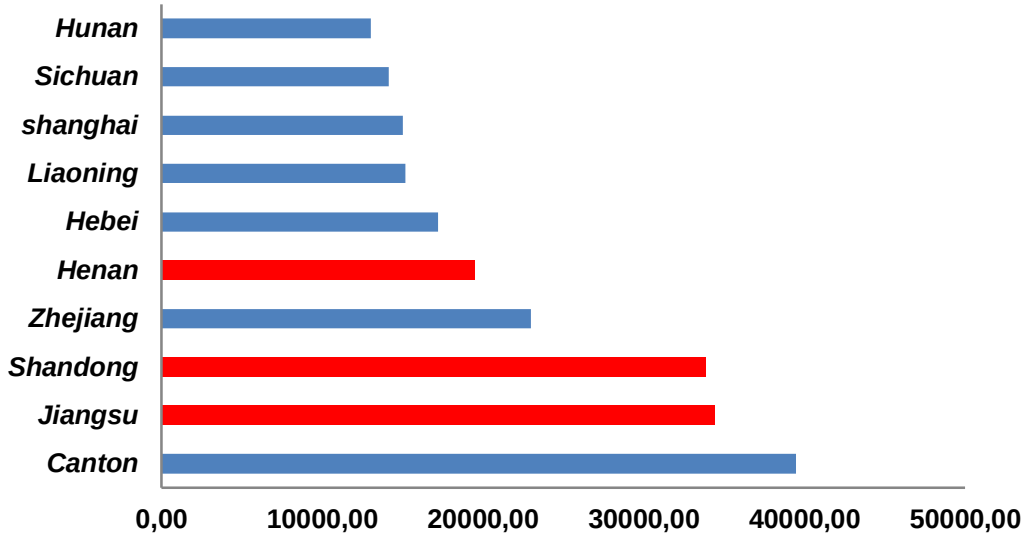
Source: drawn by the author

Figure 45.Top ten provinces with great population. Unit: 10000 persons



Source: China´s statistical year book, 2010

Figure 46. Top ten provinces with great GDP value. Unit: 10 million euros



Source: China´s statistical year book, 2010

Yangzi River Triangle Economic Area is one of the three most important economic areas in China. *Yangzi* River Triangle Economic Area is made up of three provinces, which are *Jiangsu, Zhejiang* y *Shanghai*. It is named triangle because their locations in the map form a triangle in the downstream of *Yangzi* River. These areas have abundant natural resources, full intellectuals and high technology, open economic policies and extremely developed foreign investments. Shandong province develops especially fast in recent ten years, mainly thanks to great development in the livestock sector harbor-related business. China´s government is investing heavily to establish a new economic area in the downstream of Yellow River, and it incorporates *Shandong* province. Henan province is one of the important economic parts in middle-east China, and one of its most important economic supports is pig industry.

With regard to pork sector, all the three provinces are big pig production and processing areas. Pig production of these three provinces in 2009 is listed in table 40.

Table 40. Top ten provinces with great GDP value. Unit: 10 million euros

Ranking	Province	Pig production
1	Sichuan	6915,5
2	Hunan	5508,7
3	**Henan**	**5143,6**
4	**Shandong**	**4155,7**
5	Hubei	3735,5
6	Canton	3601,0
7	Hebei	3332,9
8	Guangxi	3119,9
9	Yunnan	2824,5
10	**Jiangsu**	**2748,1**

Source: China´s statistical year book, 2010

According to the statistics provided by China´s meat organization, 19 companies in *Shandong* province, nine companies in *Henan* province and four companies in *Jiangsu* province listed 50 the most competitive meat producing companies in China in 2005, which in all account for 64%. And among the 44 companies that slaughter more than 200,000 heads of pigs in 2005, 17 of them are companies in *Jiangsu*, *Shandong* or *Henan* province. The biggest three companies *Shuanghui, Jinluo and Yunrun* also come from *Henan*, *Shandong* and *Jiangsu* respectively. There are 434 pork slaughtering and processing companies in Shandong Province in 2008 and 98 of them slaughter 200000 heads of pigs per annum. It is found that pork producing companies are concentrated in these areas, which is proper for the survey as the questionnaire object is pork slaughtering (processing) industries.

Totally, 350 questionnaires were conducted in these three provinces in the form of personal investigation, personally delivery and electronic delivery (see table 41). The total returned ratio is 93.1% with 6.9% of the questionnaires are not valid.

Table 41. Information of questionnaires

Provinces	Totally	Face-face	Delivered personally or by e-mail	Effectively returned	Returned ratio
Jiangsu	100	60	40	92	92%
Shandong	150	50	100	139	92.7%
Henan	100	40	60	95	95%
Total	350	150	200	326	93.1%

Finally, 326 questionnaires were effectively collected. The 326 slaughtering (slaughtering-processing) companies differentiate in their scales, core businesses and governance structure with their upstream chain agents, shown in the following table 42, table 43 and table 44.

Table 42. Scales of 323 companies

Scale	Number	Ratio
Big scale	60	18.4%
Middle and small scale	266	81.6%
Total	326	100%

According to the Ministry of Commerce in China, a company which slaughters more than 200,000 heads of pigs per annum is a big scale in the pork industry. We can see from table 3 that big scale companies still account for a smaller percentage of the pork industry in China.

Table 43. Core businesses of 323 companies

Core business	Number	Ratio
Slaughtering only	262	80.4%
Slaughtering and processing	64	19.6%
Total	326	100%

Among the 326 companies, 80.98% still conduct spot market transactions with their upstream pig farmers, while the rest 19.02% are using governance structures such as contract, cooperatives and integrations (see table 44).

Table 44.Governance structures of 323 companies

Governance structure	Number	Ratio
Spot market	264	80.98%
Company-production base-pig farmers	27	8.29%
Company-cooperatives-pig farmers	24	7.36%
Integration	11	3.37%
Total	326	100%

The data used in this study comes from surveys to the measurement of the seven variables in the empirical model. The design of the questionnaire has considered the related studies reference and mostly the need of this research. It is designed according to the explanations of the measurement items which are listed in table 32 to table 39. Likert-type scale method is used to measure these items, and it is widely used in psychology and management, etc. research areas. Likert-type scale usually uses 4 to 6 point scale as measurement levels, in which 5-point scale has a better internal consistency. The commonly used options for items are listed in Table 45.

Table 45. Governance structures of 323 companies

Example 1	Example 2	Example 3	Example 4
Totally coincide	Always like this	Strongly agree	Extremely important
Coincide	Often like this	Agree	Important
Sometimes coincide	Sometimes like this	Neither agree or disagree	Not sure
Does not coincide	Rare like this	Disagree	Not important
Totally not coincide	Never like this	Strongly disagree	Extremely not important

The research uses five-point Likert-type scale anchored from “strongly disagree” to “strongly agree” is adopted in the measurement.

5.3.2 Reliability analysis of variables

As stated in section 5.2.1, reliability reflects the reliability and consistency of test results. It is index that how measurement tools could stably measure the variables. In this study, statistical software SPSS 17.0 is applied to deal with the data, and the reliability values of variables exported by SPSS are listed as followed.

Cronbach's α analysis for reliability of transaction cost is stated in the following table 46.

Table 46. Cronbach's α analysis for reliability of transaction cost

Code of item	Cronbach’s α
SRC 1 SRC 2	0.703
INC 1 INC 2	0.786
BAC 1 BAC 2	0.793
DEC 1 DEC 2	0.744
MOC 1 MOC 2	0.846

Cronbach's α analysis for reliability of governance structure choice is stated in the following table 47.

Table 47. Cronbach's α analysis for reliability of governance structure choice

Code of item	Cronbach’s α
IGS 1 IGS 2	0.776
SGS 1 SGS 2 SGS 3	0.915

Cronbach's α analysis for reliability of uncertainty is stated in the following table 48.

Table 48. Cronbach's α analysis for reliability of uncertainty

Code of item	Cronbach's α
ENU 1 ENU 2 ENU 3 ENU 4	0.907
BHU 1 BHU 2 BHU 3	0.842

Cronbach's α analysis for reliability of asset specificity is stated in the following table 49.

Table 49. Cronbach's α analysis for reliability of asset specificity

Code of item	Cronbach's α
PAS 1 PAS 2	0.851
RAS 1 RAS 2	0.965

Cronbach's α analysis for reliability of collaboration advantages is stated in the following table 50.

Table 50. Cronbach's α analysis for reliability of collaboration advantages

Code of item	Cronbach's α
LGA 1 LGA 2	0.764
CRA 1 CRA 2	0.859
IEA 1 IEA 2	0.860
TEA 1 TEA 2	0.860
INA 1 INA 2	0.785
QMA 1 QMA 2	0.843

Cronbach's α analysis for reliability of willingness to collaborate is stated in the following table 51.

Table 51. Cronbach's α analysis for reliability of willingness to collaborate

Code of item	Cronbach's α
WTK 1 WTK 2	0.884
WTE 1 WTE 2	0.792

Cronbach's α analysis for reliability of willingness to collaborate is stated in the following table 52.

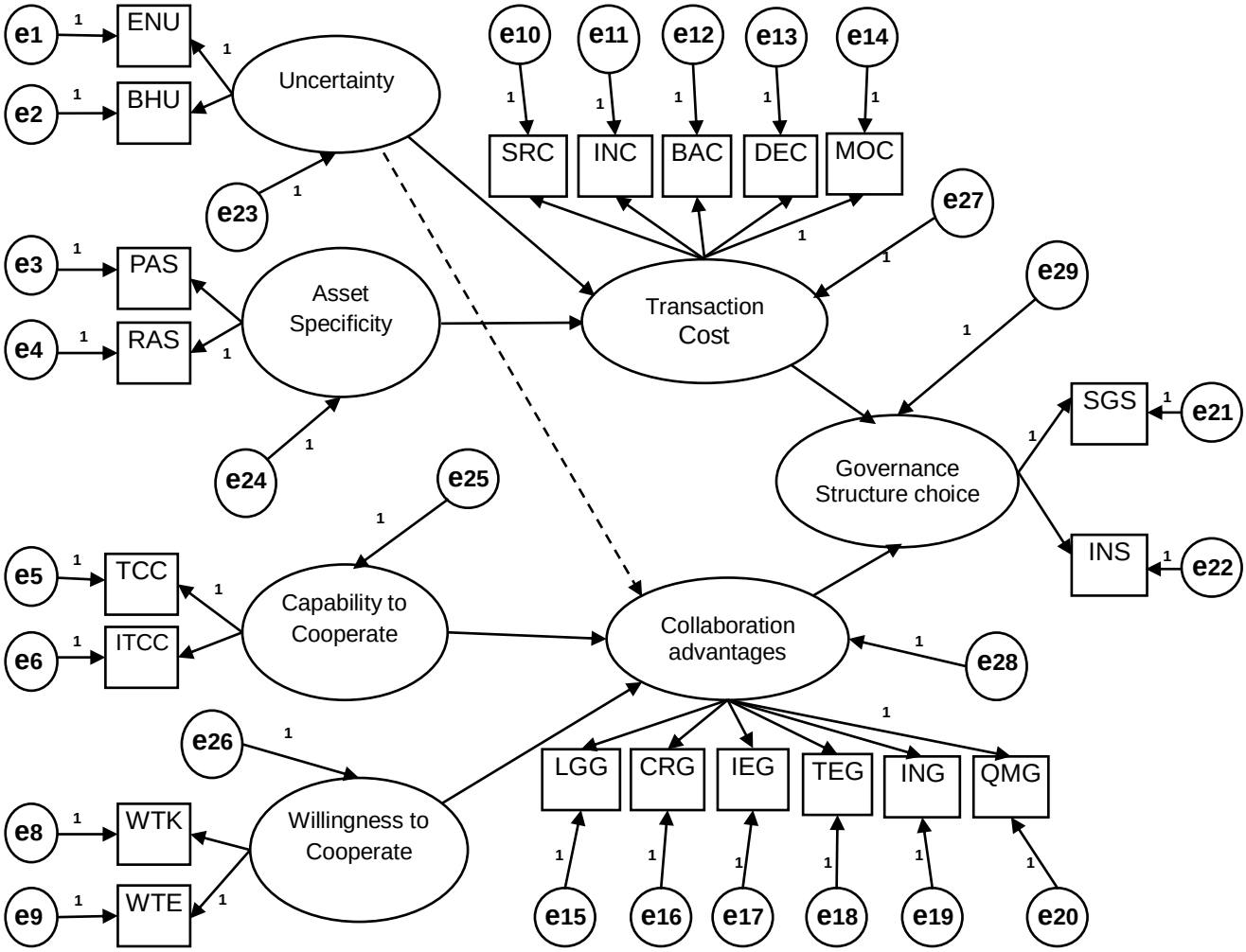
Table 52. Cronbach's α analysis for reliability of willingness to collaborate

Code of item	Cronbach's α
TCC 1 TCC 2 TCC 3	0.902
ITCC 1 ITCC 1 ITCC 1	0.890

From the results, it is found that all the reliability values of variables exceed 0.7, which means that the data collected are reliable, and they are suitable for the use of further model test.

Based on the measurement variables design and reliability analysis, the research gives the complete structural equation model as follows. In SEM model, latent variables are usually demonstrated in ellipse and measurement variables are usually drawn in rectangle.

Figure 47. Complete Structural Equation Model



5.3.3 Model results and explanations

According to structural equation analysis procedures, goodness of model fit should first be tested to determine whether the model is well built. Bagozzi and Yi (1988) pointed out that the goodness of structural equation fit should be evaluated through three aspects, which are preliminary fit criteria, fit of internal structure of model and overall model fit. The preliminary fit criteria are mainly used to test the model fitting series errors, identification problems or input errors, etc. Fit of internal structure of the model is mainly used to evaluate the significance of estimated parameters of the model and reliability of latent variables.

Overall model fit goodness of is used to evaluate the fit between model and observed data. The overall model has three types, which are absolute fit measures, incremental

fit measure and parsimonious fit measures. Absolute fit measures are used to determine how the overall model can predict the covariance matrix or correlation matrix. Main indicators are value of chi-square statistics, goodness of fit index (GFI), square root of the average residual (RMSR), mean square root of approximate error (RMSEA) etc., in which when GFI value is greater than 0.8 and RMSR and RMSEA values are less than 0.1 means the model has good fit. Incremental fit measures include indicators such as adjusted goodness of fit index (AGFI), normed fit index (NFI), comparative fit index (CFI) etc., when AGFI and NFI values are greater than 0.9 means that the model is well fit. Indexes for parsimonious fit are a parsimonious normed fit index (PNFI), parsimonious goodness of fit index (PGFI), etc., usually PNFI, PGFI value higher than 0.9 is ideal. However, Doll et al (1994) consider that the criterion that GFI and NFI should be greater than 0.9 is too conservative, the model is quite well fitted when GFI and NFI are greater than 0.8.

Based on these indexes, statistical software Amos 17.0 and SPSS 17.0 are applied into the SEM model test and the results of the model fit is shown in table 53.

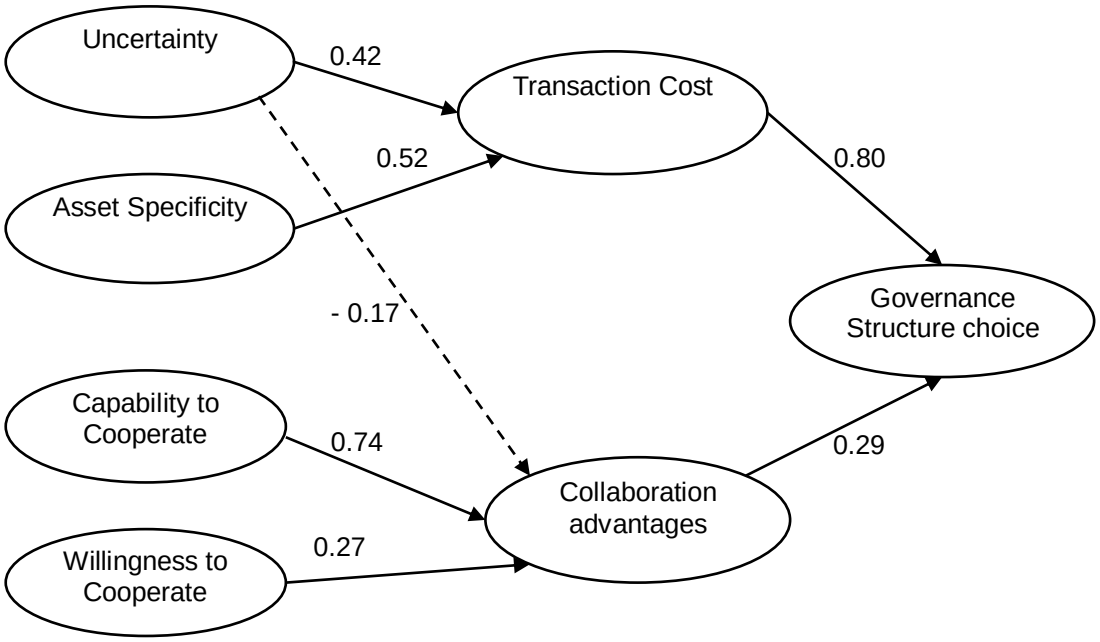
Table 53. Model fit indicators

Model fit indicators	Value	Ideal value	Explanation
CMIN/DF	2.24	---	---
GFI	0.911	>0.9	Ideal
RMR	0.035	<0.05	Ideal
RMSEA	0.081	<0.05	Accepted
NFI	0.965	>0.9	Ideal
TLI	0.946	>0.9	Ideal

From table 53 we can see that observed data is well fit the model, which means the data collected and model could well reflect the real situation.

The path parameters between variables are shown in figure 48 and the test results of parameter is shown in table 54.

Figure 48. Paths and parameters of SEM Model



The parameters and their regression weights are listed in table 54.

Table 54. Regression Weights (Group number 1-Default Model)

Paths	Estimate	S.E.	P
Transaction Cost ← Uncertainty	0.422	0.014	*** (significant)
Transaction Cost ← Asset Specificity	0.522	0.022	*** (significant)
Collaboration advantages ← Capability to collaborate	0.741	0.026	*** (significant)
Collaboration advantages ← Willingness to collaborate	0.269	0.015	*** (significant)
Collaboration advantages ← Uncertainty	-0.171	0.014	*** (significant)
Governance Structure Choice ←Transaction Cost	0.805	0.033	*** (significant)
Governance Structure Choice ←Collaboration advantages	0.292	0.016	*** (significant)

Note: the parameters are estimated unstandardized values.
S.E.: Standard error of regression weight
P: Level of significance for regression weight at 0.1% level.

From the results we can see that all the paths passed the regression test. Combined with the hypotheses raised in this research, the final hypotheses test result is shown in table 55.

Table 55. Tests to hypotheses according to the model

Hypothesis code	Hypothesis content	Result of model
H1	Transaction cost has positive relationship with governance structure choice	Approved
H2	Uncertainty has positive relationship with transaction cost	Approved
H3	The relationship between asset specificity and transaction cost is positive	Approved
H4	Collaboration advantages and governance structure choice have positive relationship	Approved
H5	Willingness to collaborate has positive relationship with collaboration advantages	Approved
H6	Capability to collaborate has positive relationship with collaboration advantages	Approved
H7	Uncertainty has negative effect on collaboration advantages	Approved

It is found that all the hypotheses given by the research are well proven by the model in the case of China´s pork chain. Both transaction cost and collaboration advantages have influence on governance structure choice, although the influence of transaction cost is stronger than collaboration advantages according to the model results. When facing higher transaction cost and good collaboration advantages, cooperative partners tend to choose more intense and stable governance structures to minimize the transaction cost and maximize the collaboration advantages. It also means that cooperative partners´ purpose of choosing more intense and stable governance structure is not only lowering transaction cost, but they also want to increase collaboration advantages. The relationship between transaction cost and governance structure choice gives evidence in China to transaction cost theory and organizational theories in new institutional economics. It is in line with Williamson´s point on the relationship between transaction cost and vertical integration. Collaboration advantages are proven to be another factor that influences governance structure choice. It does not influence so much to governance structure choice like transaction cost, but it draws attention that when exchange partners choose governance structure, the expected collaboration advantages they will get is also an important influencing factor.

The influences of uncertainty and asset specificity on transaction cost are confirmed under the transaction cost theories base. Great uncertainty of the environment and behavioural uncertainty between exchange partners increase the transaction cost. A company with high specificity also exerts high transaction cost. These conclusions in transaction cost theories also find their proofs in China´s pork chain.

It is proven in this case that “collaboration advantages” is also an influencing factor

that affects final governance structure choice. In this study, two factors that could affect expected collaboration advantages are confirmed as well. Companies´ capability to collaborate has greater influence on collaboration advantages than that of willingness to collaborate on collaboration advantages, which means strengthen companies´ capability helps improve the collaboration advantages that would be jointly claimed. On the other hand, the willingness to collaborate is also important as it also has a positive relationship with collaboration advantages.

Finally, uncertainty shows a slight negative relationship with collaboration advantages, which means that uncertainty is a factor that influences both transaction cost and collaboration advantages. More uncertain the environment and the behaviour between exchange partners, collaboration advantages suffer more loss.

5.4 Chapter summary

Chapter five is aimed to empirically study the governance structure choice in China´s pork chain.

First, it reviewed the theories related with governance and organizations of the chain, mainly focusing on transaction cost theories and new institutional economics, transaction value analysis, resource based view theories, etc., and it proposed tries to establish a research framework by introducing seven hypotheses based on the theoretical reviews. It proposed that governance structure choice is a co-effect of both transaction cost and collaboration advantages instead of transaction cost only.

Then it explored the influencing factors that could affect the transaction cost and collaboration advantages respectively, proposing that uncertainty and asset specificity are influencing factors on transaction cost and willingness to collaborate and capabilities to cooperate are influencing factors on collaboration advantages.

Based on these hypotheses, the research gives a conceptual model for the later study. Therefore, SEM method and the data from China´s pork chain are used to empirically test the hypotheses as the SEM model is suitable for the study design. With the survey in China´s pork chain, the first hand data for the study is obtained. This data is dealt with SPSS 17.0, and it is applied into the calculation of AMOS 17.0 with model results. It is found that the observed data from China´s pork chain is well fit the SEM model established in this model. Furthermore, the seven hypotheses raised in the

study are all approved. The whole framework of this empirical study was finally well conducted and adjusted into the China´s pork chain case.

6. Concluding remarks and suggestions

6.1 Research conclusions

In this chapter, the research conclusions achieved are described as follows:

First, general situations of feed industry in China and Spain are quite similar, big companies lead the industry, and they both face problems of price fluctuation in raw materials. The difference is the role that feed producers play in the pork chain in China and in Spain. Feed producers are great integrators and act as focus companies in the Spanish pork chain. But integrations are mainly driven by big processors in China.

Second, both China and Spain are big pig producers. China produces pigs in a concentrated area which is in the east China, while there is almost no pig production in the northwest area due to its different natural environment. The pig production Spain is spread around the country; almost all of the autonomous communities have pig production.

Third, with regard to governance structure of the pork chain, pig production in China is still dominated by small-scaled household farmers. Though the specialized pig production and commercial pig production are increasing rapidly, their production does not account for the main part of the pig production, the industry has a low industrial concentration. On the other hand, , there are also different scaled farms in Spain producing pigs, but generally, the scale of pig production in Spain is much larger than that in China. The production structure in China is undergoing changes while the production system is quite mature and stable in Spain. In addition, the Spanish pig production has its own features as it has intensive farms and extensive farms, in which extensive farms usually produce pigs for Iberia cured hams. Continuously, it could be generated that the structure of Chinese slaughtering and processing industry is more complicated than that of Spain. The designated slaughter system could not be completely implemented, especially in suburban and rural areas, which caused a lot of potential safety problems of pork. On the other hand, big processors who are integrated with slaughterhouse co-exist in this industry, they process big amount of pork with better quality and safety, targeting urban market. This industry in China has a low level of concentration. On the contrary, the slaughtering

and processing industry is quite concentrated. Companies vary in scales, but many of them put great importance in safety and quality systems. They implement the quality standards that require by the nation and also European Union if they are doing exporting business.

Governance of the Chinese pork chain is less developed. An intense and stable relationship among the chain actors is still not established, although some big processors have conducted vertical integrations in different forms, they are not well implemented. Cooperative is not well accepted in China, the chain actors in pork chain in China feel that they don't understand the conception of cooperatives well, and they don't know if it is legal in China.

Governance of the Spanish chain develops into its own structure according to its national situations, vertical integration and horizontal integrations both exist in the pork chain in Spain.

Then, it is found that the distribution channel in China and in Spain is quite different. The popular wet market (*"Nóng mào"* market) in China is not prevailing in Spain, though Spain also has wet market, the hygiene conditions are quite different in the two countries. The cooling and freezing conditions in wet market in China are not sufficient, "hot fresh pork" draws a lot concern about the safety of the pork.

There are few brand stores in Spain with the brand from slaughterhouse or processing companies directly. Spanish meat industry companies distribute their products through different channels such as traditional shops or supermarkets and hypermarkets instead of brand stores. Actually, many of the traditional shops in Spain are operated by families for a long time, but as in China, it was not permitted to own private stores or companies until the late 1970s, this kind of private-owned traditional store is not popular in China.

Fifth, consumption of pork per capita in China is less than that in Spain. The Spanish people consume more processed pork than Chinese consumers. In China, it shows a phenomenon that urban areas consume more than that of rural areas, but the difference is becoming less. While in Spain, the consumption in urban and rural areas is not so different. In both countries, main pig production areas are also main pork consumption areas.

China is not a big exporter of pork, the main pork product it imports is offal. Spain is still not a main pork exporter to China, but Spain plays an active role in exporting pork and its products to European countries.

With regard to pork chain management, it is found firstly that pork chain in Spain has a simpler chain structure; the median links are not so many like the pork chain in China.

In regard to information use, Spanish pork chain actors have sufficient information of each link of the chain. While not all the Chinese pork chain actors have recorded the information of their link correctly and completely. With regard to information exchange, chain actors in China provide information to their upstream and downstream actors, while an information asymmetry exists as the information could be transferred with great transparency through complicated chain links. Some chain actors, especially the dispersed pig farmers and small butchers take a moral hazard to hide information. However, big companies give emphasis in communication and exchanging information with their chain partners.

Concerning traceability, Spain has already adopted the European traceability system and other national systems, while China is still undergoing the exploration and practice of traceability. It is difficult for the Chinese pork chain to develop traceability system at present.

In regard of logistics systems, Spanish meat industries mostly use their own logistics system as they don´t trust the quality and efficiency of independent logistics companies. They lay emphasis in cold chain transportation to ensure the safety of their products. While logistics still remains a new concept in China's pork chain as a cold chain is only well adopted in big companies. In most of the *"Nóng mào"* market, hot fresh pork is popularly sold.

Spain and China have different quality management systems. Comparatively speaking, Spanish management system is clear and simple, while the management system in China has a lot of problems such as overlap of administration. This has drawn the attention of the management departments and central government in China.

As to the regulations and standards, each country adopts its standards. However, obviously, Spain adopts more of the international standards such as ISO and HACCP

than China. These standards are still not obligatory in China as many meat industries are not able to meet the standards.

In the various differences in the pork chain and pork chain management between China and Spain, the most different aspect is the governance structure of the chain, and this is one of the important factors that differs the pork safety situations in China and Spain.

Concerning the international pork chain between Spain and China and pork commerce between the two countries, it is found that:

a) The structure of the Spanish-Chinese pork chain differs according to different products and their different distribution channels.

b) Governance between Spanish industries and Chinese importers is a spot market relationship, which is not long-term and stable governance. It is one of the reasons why the movement of pork is not smooth and trade amount is not big. This is considered as a paradox, because China´s pork safety and quality level is quite low, but the government requires foreign pork products´ safety and quality to get a high level. It means that Spanish companies should compete with all the possible exporters when China needs to import pork. Joint ventures would be a suggestive form to strengthen the bilateral relationship considering that many of the Spanish companies are small and medium sized

c) Information exchange is neither sufficient nor efficient. The Chinese consumers do not know well about the Spanish pork products and Spanish companies needs to study more about China's market. This is also one of the defects that hinder the movement of pork from Spain to China. It is implied that Spanish companies need to make more effort in promoting their products in China's market.

d) Chinese government has a special attention to food safety of imported products. The high-quality standards set by China have, in reality, formed a trade barrier between the two countries, that's one of the main reasons why the movement of pork is hindered

e) Spanish companies should develop proper price strategies to make their products price competitive. Factors such as cost of production, transportation, tariff, expected profit margin and competitors' price should be carefully calculated.

As governance structure is one of the important factors that influence pork safety in China, chapter five of the thesis studies the governance structure choice in China empirically, and it gets several conclusions:

(1) Transaction cost theory is confirmed as one of the most important theory references in studying of governance of supply chain. In China´s pork chain case, transaction cost is the most important factor that influences the choice of core pork chain agents´ choice in governance structure. In the process of chain governance structure change and evolution, transaction cost has been a key reason.

(2) Although transaction cost has been considered and proved as a key reason in the chain governance structure evolution, another variable, which is named collaboration advantages in this study, is also proven as an influencing factor. A combined logic of transaction cost theory, transaction value analysis and resource based view is shown in the study of chain governance choice, which makes the governance choice research more complete. Collaboration advantages should not be neglected, because on one hand, collaboration advantages are the mutual benefits that come about naturally from transaction process, on the other hand "collaboration advantages" is a factor that exchange partners will consider when they need to choose the exchange mechanism. The empirical research gives evidence that the exchange partners set getting maximum collaboration advantages as transaction objectives besides minimizing the transaction cost.

In China´s pork chain case, spot market relationship dominates the governance structure among the numerous backyard pig farmer and small family slaughterhouse as they are connected by acquaintance relationship and the transaction cost in turn is low. Their relationship is reliable as they know each other in the neighborhood; as a result, spot market relationship is suitable for their exchange.

However, the transaction between large-scale slaughtering and processing industries and small-scale pig producers is becoming difficult as the big

processing industry is facing numerous small-scale pig producers with whom they have difficulty in searching suitable pig supplier, difficulty in signing contract with each backyard pig producer. These contribute to the pork safety and quality problems, and they make the transaction cost high. Through the more intense and stable relationship between processing industries and pig producers, processing industries reduce the transaction cost and improve the collaboration advantages with their chain partners, in which quality and safety collaboration advantages be increased, meaning that processing industries are able to provide consumers products with better quality and higher safety.

(3) Transaction cost is influenced by environmental uncertainty, behavioral uncertainty and asset specificity in this research, which is in line with the transaction cost theory of Williamson. In China´s pork chain case, behavioral uncertainty is created by the hold-up behaviors of great numbers of small pig producers. They try to hide information, which makes the transaction between them and processing industries difficult. Therefore, to avoid behavioral uncertainty of small pig producers, large-scale processing industries tend to establish by more stable and intense relationship with their upstream chain agents.

(4) Collaboration advantages are influenced by the willingness to collaborate and capability to collaborate. With the fast growth of big scale slaughtering and processing industries, they are more capable to drive more intense and stable relationship with their downstream chain agents. On one hand, they are willing to know their partners, having the intension to cooperate; on the other hand, they have a great capability in capital, technology and reputation, etc. to cooperate. These make the processing industries´ concern on the achievement of joint value during the transaction possible.

6.2 Proposed implications and suggestions

Considering the conclusions generated from the whole study, several implications and suggestions are stated as follows:

First, there are several problems in the international pork chain between Spain and China that hinder the pork trade, which are information exchange difficulties, quality system trade barriers, etc. China´s government has too much concern on the quality and safety requirements to Spanish pork products, which makes trade difficult to

complete. The two countries need to establish a more stable and intense trade relationship. They also should make the information exchange sufficient and efficient and try to break trade barriers. Spain should consider proper price strategies to win the Chinese pork market.

With the regard to the marking of Spanish pork products exported to China, the strategy could be explained from 4P (Product, Promotion, Place, Price) marketing perspective. The pork product provided to China´s market should offer high quality, safety, good service, and they should be tagged with clear instructions and description of the products in Chinese. To promote the pork products, the Spanish companies should be consumer-oriented, trying to educate Chinese consumers to know and to purchase the products. For special products, such as *Jamón*, it will be very important to define the proper consumer groups. Promotions will be conducted to consumers with high income and high willingness to consume foreign products. Different products should be distributed with different channels. Offal could be distributed through big supermarkets, while *jamón* should be distributed through good hotels, restaurants, golf playgrounds, etc. Offal products should offer a competitive price to win the market from existed foreign exporters such as Denmark, United States, Canada and France. But *jamón* could be sold by high price to get great premium.

Secondly, the new forms of governance structures in China´s pork chain such as cooperatives, vertical integrations, own production bases, etc. play the important role exchange partners to achieve their intention to increase collaboration advantages and reduce transaction cost during the transaction process. Although the spot market relationship still dominates the pork chain in China, they are being taken over by new governance structure forms as they are the trends China´s pork chain governance structure evolution.

Thirdly, apart from the chain agents take new governance structures to reduce transaction cost, pork industry administrators should make an effort to maintain a stable industrial environment with steady policies, sufficient industrial information, etc., which also will help reduce a transaction cost of the chain. Meanwhile, the administrators should take means to encourage the merge of small pig producers and small pork processors in order to help them get scale interest and reduce their transaction cost with other chain agents. Furthermore, administrators should give key chain agents of the chain suitable support to help them get more capability to facilitate vertical and horizontal chain integration.

Finally, the key chain agent of China´s pork chain, big slaughtering and processing companies should give full play to their capabilities to cooperate with their chain partners to minimize the transaction cost and maximize the collaboration advantages, driving and developing the governance structure change

7. Creativeness and limitations

7.1 Creativeness

Based on the literature review, the author considers that the study has several possible creative points, which are:

First of all, this paper studies the pork trade between Spain and China from an international pork chain perspective. The international pork chain comes from the pork trade between Spain and China, which started from 2007. This study takes the initiative to study the international pork chain between China and Spain, which is new and unique.

Secondly, this research gives a positive analysis of the governance structure choice in China´s pork chain case. The empirical study has a strong and first-hand database from China´s pork industry, and it makes the results convincible and unique.

Finally, and most importantly, this research introduces a method of studying governance structure choice of the supply chain from transaction cost and collaboration advantages perspectives instead of transaction cost perspective, which makes the research of this area more completed. The framework of this method, which includes the theoretical overview, hypotheses, model construction, variables measurement, questionnaires design and model test could also be applied into future governance structure choice study in other agricultural chains or other countries.

7.2 Limitations

Like all the other studies, this research has its limitations, which are sated as follows:

First of all, the empirical study is still static. As it is mentioned in section 5.2.2, governance structure choice is a dynamic process, this study tried to explain the initial stage of governance structure choice, but actually chain agents are conducting the whole choice process from initial stage, processing stage to reconfiguring stage.

Secondly, this research chooses key chain agents as study object to make the study easier, but in reality, key chain agents are not able to represent the whole chain. The transaction cost of the chain is different as the transaction cost between two chain agents.

Thirdly, this research has made an effort to make all the measurements of transaction cost and gains to be in line with the ¨mutual¨ concept, but the survey target is processing and slaughtering industries instead of both processing industries and small pig producers. Although all the questionnaires are designed to reflect the mutual situation, the mutual transaction costs and gains could not be represented by the transaction cost and gains stated by processing industries from its one side.

Finally, the Likert-type scale method itself has limitations. For example, the questionnaires depend a lot on the subjective judgments of the interviewee, which makes the model results has deviations.

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Appendices

Appendix A: Experts interviewed in China and Spain

-Experts in China

1. **Dr. Huang Ruihua**
   Consultant on animal breeding and reproduction in China
2. **Mr. Huang Xiaoguo**
   General Manager of Kangle Co. Ltd
3. **Mr. Gu Yueqing**
   Head of veterinary medicine station and cooperatives in preservation of special pork species in Changzhou city, Jiangsu Province, China
4. **Mr. He Zhengdong**
   Director of the Provincial Animal Husbandry Bureau of the Department of Agriculture and Forestry
5. **Mr. Meng Lizhong**
   Deputy General Manager for logistics and marketing, Huai'an Sushi meat group
6. **Mr. Lin**
   Manager for quality control and marketing, Hormel Co. Ltd, Shanghai branch
7. **Prof. Ying Ruiyao**
   Professor and expert in cooperatives and vertical coordination, Nanjing University of Agriculture (NAU)
8. **Prof. Chen Chao**
   Professor and expert in supply chain management of NAU
9. **Professor Lu Zhengping**
   Veterinary on medicine research and official veterinary management
10. **Ms. Li Ling**
    General Secretary of Shandong Meat Association

Mr. Qiang Faqi

General Manager of Nanjing Hejisheng Animal Feed Co. Ltd

12. **Mr. Cai**

Head of Nanjing Designated Pork slaughtering Management Office

13. **Mr. Chen**

Manager of the fresh product section, Suguo Supermarket Co. Ltd

14. **Mr. Wu Guorong**

Animal quality control and inspection in Lishui county, Nanjing

-Experts in Spain

1. **Mr. Ramón Armengo**

President of cooperatives in pork sector in Spain

2. **Mr. Francesc Ollé Marrugat**

Representative counselor of Mercolleida

3. **Ms. Carmen Alonso Garcia-Monchales**

Veteran technique of D'IVARS cooperative in Lérida

4. **Ms. Teresa Guillén Zulueta**

Export Area Manager of ElPOZO ALIMENTACIÓN, S.A. Murcia, Spain

5. **Mr. Manuel José Carcía Vicente**

Fresh meat commercial division of ElPOZO ALIMENTACIÓN, S.A. Murcia, Spain

6**. Mr. David Kneib**

Area Export Manager of Noel Alimentaria, S.A.U., Spain

7. **Ms. Cristina Mañá**

International Department, Federació Catalana d´Indústries de la Carn (FECIC)

8. **Mr. Marc Oliveras i Trullols**

Counselor of internationalization service of Promotora d´Exportacions Catalanes SA (Prodeca)

9. **Mr. Marco Antonio Pérez Castillo**

Administrative director, Cárnicas Villa de Madrid, S.L., Mercamadrid, Spain

Appendices

Appendix B: Questionnaire to the Spanish pork companies

Basic information of the companies:
1 Name

2 Place

3 Dedications

Questions:
1 Are you interested in exporting your products to China?

2 How do you see the possibility of exporting your products to Chinese market?

3 In your opinion, what kind of pork products will get a better acceptation in China? (Fresh pork, offal or cured pork products)

4 In your opinion, what are the main obstacles or difficulties for Spanish meat industries to export to China?

5 If your company is exporting your pork products to China, what have you done when you were preparing? And what are you doing at present? And how are your products´ sales now in China's market?

6 If your company is not exporting to China, what do you think should be prepared?

7 what kind of company mode do you think will be suitable for you to export to China? (Joint ventures, 100% ownership inventions or others)

8 which are the better channels to distribute your products in China? (Supermarket, foreign restaurant, consumer cooperatives or directly through Chinese importers)

Appendix C: Company list who export pork to china (13th of April, 2011)

Appendices

Appendix D: Questionnaires to slaughterhouses (processing) companies in China's pork chain

Your name: _____ Your title: _____
Contact information：_____
Company's Name：_____ Company Location: _____

Declarations：

1. The questionnaire is only for research purpose, the results to be generated will not be used for any business intention.
2. Please fulfill the questionnaire as objective as possible.
3. The score-value questions are evaluated with five-grade marking system
4. If you have any doubts about this survey, please don't hesitate to contact us

Thank you very much for taking time from your busy schedule to fulfill our questionnaire!

Department of Economics and Management, Nanjing Agricultural University, China
Department of Agricultural Economics, Polytechnic University of Madrid, Spain

[A] Basic information of your company

1. The main work you are responsible for your company is:

（1）Sales/market （2）Purchasing （3）Logistics （4）Production/Operation（5）R&D（6）Others_____

2. The main business of your company is (are):

(1) Pig slaughtering (2) Pork processing

3. The fixed asset of your company is:

（1）Below 200,000 Yuan（2）200,000 to 1 million Yuan （3）1 to 5 million Yuan

（4）5 million to 10 million Yuan（5）more than 10 million Yuan

4. Your sales volume: _____

Pigs slaughtered annually _____

5. Do you have your registered trademark? （1）Yes （2）No

6. Do you have your own brand store? （1）Yes （2）No

7. Have your company had the following certification? (Multiple Choices)

（1）GMP （2）QS （3）HACCP （4）ISO （5）Others_____

[B]The relationship between your company and your upstream agent

1. In which way you do business with your biggest upstream supplier?

(1) Oral Contract (2) sign sales contract (3) sign producing and sales contract (4) upstream agent participate my company (5) I participate my upstream supplier (6) others _____

2. When you have to choose the upstream chain supplier, the main factors that you consider are: (please give an order to the following factors according to their importance, from high to low, in your opinion)

（1）Quality（2）Production scale（3）Credit

(4) Producing experience

(5) Stable supply from the supplier （6）Low cost of the supplier

Order: _____

5.How do you evaluate your relationship with your upstream supplier？

[C] Changes that happen between you and your upstream supplier in terms of your linking way

1. In recent 5 years, has the linking way between you and your upstream supplier been changed?

（1）Yes（please continue with question 2） （2）No（please go to sector D）

2. The link between you and your supplier is looser o tighter?

（1）Tighter （2）Looser

3. Please describe how the link between you and your supplier has been changed?

4. The factors from outer environment of the company that has changed the link are: (please order the following factors according to their importance according to your opinion)

（1）Current competition between companies

（2）Formal institutional change (e.g. The change of the related regulations and laws)

（3）Potential new comers

(4) Bargaining capability of the suppliers

(5) Informal environmental change

(6) Threaten of the substitutions

Ranking _____

7. The factors from inner environment of the company that has changed the link are: (please order the following factors according to their importance according to your opinion)

（1）the change of the scale of the company

（2）the change of the financing ability of the company

（3）the change of the company objective

（4）company logistics

（5）company technology

（6）Informatization management of the company

Ranking：_____

[D] Questions for scoring

- **Instructions for the score：**

Please give a score *"1 to 5"* to the following items according scales from "strongly disagree" to "strongly agree":

"1" means that you **strongly disagree** with the description that the item gives.

"2" means that you **disagree** with the description that the item gives.

"3" means that you **agree** with the description that the item gives **to some extent**.

"4" means that you **agree** with description that the item gives.

"5" means that you **strongly agree** with the description that the item gives.

- **Example:**

1. Regulations of the industry changes frequently

If you are strongly agree with the item "Regulations of the industry changes frequently" please choose "5"; agree, choose "4", agree to some extent, choose "3", disagree, choose "2", strongly disagree, choose "1".

All items go after this example.

- **Notes:**

"Cooperative partner" means your upstream chain agents which have any form of cooperative relationship (acquaintance, oral contract, formal contract, formal/informal cooperatives, joint venture, joint ownership, merger/acquisition etc.) with you.

If you don't have any cooperative relationship with any upstream agents, then it refers to upstream chain agents that do business with you. "Both parts" means you and your cooperative partner

- **Transaction Cost**

1. It is very difficult to get information about the pig industry 1 2 3 4 5

2.	It is very difficult find proper business partner (pig supplier)	1	2	3	4	5
3.	It is very difficult to know the information about your cooperative partner	1	2	3	4	5
4.	It is very difficult to exchange information with your cooperative partner	1	2	3	4	5
5.	It is very difficult to get on an agreement with your cooperative partner	1	2	3	4	5
6.	It is very difficult to agree on the conditions of the contract between you and your partner	1	2	3	4	5
7.	It is very difficult for you to decide to sign the contract with your partner	1	2	3	4	5
8.	It costs you a lot effort (time, fund, labour, etc.) to finally sign the contract	1	2	3	4	5
9.	It is very difficult for you to monitor your partner	1	2	3	4	5
10.	If your partner betrays the contract, you suffer great loss	1	2	3	4	5

- **Governance Structure Choice**

1.	Frequency of transactions between you and your cooperative partner is higher than that between you and a common upstream chain agent	1	2	3	4	5
2.	Your most important business of your firm only happens with your cooperative partner	1	2	3	4	5
3.	Both you and your cooperative partner rarely betray the contract	1	2	3	4	5
4.	You and your cooperative partner have a long time of cooperation	1	2	3	4	5
5.	Either you or your cooperative partner gives up your cooperative relationship easily	1	2	3	4	5

- **Uncertainty**

1.	Regulations of the industry change frequently	1	2	3	4	5
2.	Demand of the clients is uncertain	1	2	3	4	5

3. Competition among the counterparts is fierce	1	2	3	4	5
4. Technology of the whole industry changes fiercely	1	2	3	4	5
5. Your cooperative partner and you do not exchange business information well	1	2	3	4	5
6. Your cooperative partner is not reliable	1	2	3	4	5
7. Trust between you and your partner is not established for a long time	1	2	3	4	5

- **Asset Specificity**

1. If you switch to other products, you will lose a lot of investments in facilities and tools	1	2	3	4	5
2. If you switch to other products, you will lose a lot of investments in human resources	1	2	3	4	5
3. If you switch to new suppliers, you will lose a lot of investments in time and efforts in establishing relationship with your former key supplier	1	2	3	4	5
4. You invest a lot of time and effort in maintaining collaborating relationship with your most important suppliers	1	2	3	4	5

- **Collaboration advantages**

1. Logistics between you and your cooperative partner will be ensure the products supply	1	2	3	4	5
2. When emergency happens, the logistics system will not be broken easily	1	2	3	4	5
3. Payment between you and your cooperative partner could be realized quickly	1	2	3	4	5
4. Cost of cash flow between you and your partner is lower than that between you and other partners	1	2	3	4	5
5. You and your partner can share information about cost, price, product safety, quality and quantity etc.	1	2	3	4	5
6. You and you partner could use the fastest and most convenient way to communicate	1	2	3	4	5
7. You and your partner can adopt the new technology of the industry quickly	1	2	3	4	5
8. You know how to change and improve technology adjusting the demand from your cooperative partner	1	2	3	4	5

9.	You and your partner can collaborate to co-innovation	1	2	3	4	5
10.	You and your cooperative partner can benefit from the co-innovation	1	2	3	4	5
11.	You and your cooperative partner collaborate to adopt good quality management practices in the industry quickly	1	2	3	4	5
12.	You and your cooperative partner jointly to establish good practices to ensure food safety	1	2	3	4	5

- **Willingness to collaborate**

1.	You have great willingness to know your cooperative partner' s preference	1	2	3	4	5
2.	You consider the mutual knowing as the basis of cooperation	1	2	3	4	5
3.	You have great willingness to discover similarities and common interests between you and your cooperative partner	1	2	3	4	5
4.	You have great willingness to make great effort to maximize the joint value between you and your cooperative partner	1	2	3	4	5

- **Capability to collaborate**

1.	Between you and your cooperative partner, at least one has the great capital to enhance your collaboration	1	2	3	4	5
2.	Between you and your partner, at least one holds key technology of the industry	1	2	3	4	5
3.	Between you and your partner, at least one has strategic logistics systems	1	2	3	4	5
4.	Between you and your cooperative partner, at least one has good business reputation	1	2	3	4	5
5.	Between you and your cooperative partner, at least one has public appeal in the industry	1	2	3	4	5

6.	Between you and your cooperative partner, at least one has good relationship and managerial skills	1	2	3	4	5